

LEARNED SELF-REGULATION OF ARTERIAL HYPERTENSION  
UTILIZING BIOFEEDBACK AND RELAXATION TRAINING

By

JACQUELINE ZURCHER-BROWER ORLANDO

A DISSERTATION PRESENTED TO THE GRADUATE COUNCIL OF  
THE UNIVERSITY OF FLORIDA  
IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE  
DEGREE OF DOCTOR OF PHILOSOPHY

UNIVERSITY OF FLORIDA

1974

## ACKNOWLEDGEMENTS

My warmest thanks and appreciation to Dr. Robert Strippling, who chaired my dissertation committee. He provided appropriate direction and support, yet allowed me to feel that this undertaking was fully my own.

I am eternally indebted to Dr. Joseph Cauthen for providing the setting in which to carry out the study, and for his sensitive guidance and caring.

I am grateful to Dr. William Love, whose research in the area launched me into my own study. Dr. Franz Epting and Dr. E. L. Tolbert also provided assistance for which I am deeply appreciative.

Additional thanks to those who directly assisted me in completion of the study: Paula Saraga, John Butter, Lois English, Susan Edell, Judy Foote, Kate Bury, Tay Tanya, Dr. Betty Horne, and Mary Ganikos.

I appreciate the continuing encouragement of my children, Michael and Kristine, and friend, Vernon Van De Riet.

## TABLE OF CONTENTS

	Page
ACKNOWLEDGEMENTS . . . . .	ii
LIST OF TABLES . . . . .	v
ABSTRACT . . . . .	vi
CHAPTER	
I INTRODUCTION . . . . .	1
Review of the Literature . . . . .	4
Relaxation Training as a Method of Self- Regulation of Some Cardiac Functions . . . . .	5
Feedback Training as a Method of Self- Regulation of Blood Pressure . . . . .	8
Direct Control of Blood Pressure Through Instrumental Conditioning . . . . .	8
Indirect Control of Blood Pressure Using Deep Relaxation . . . . .	10
The Moeller and Love Research Study; Techniques, Design, and Outcome . . . . .	11
Summary of the Review of Literature . . . . .	16
Psychological States Associated with Self- Control and Instruments of Assessment . . . . .	16
Measurement of Feelings of Volition . . . . .	17
Psychological Changes Associated with Self-Regulation . . . . .	20
Measurement of Psychological State Changes . . . . .	21
Descriptions of Certain Psychological Processes Associated with Increased Self-Regulation . . . . .	23
Equipment Utilized in the Study . . . . .	24
Purpose of the Study . . . . .	26
Hypotheses . . . . .	27
Exploratory Questions . . . . .	27

## TABLE OF CONTENTS - Continued

CHAPTER	Page
II DESCRIPTION OF THE STUDY . . . . .	29
Methodology . . . . .	29
Instruments . . . . .	30
Subjects . . . . .	32
Procedures . . . . .	32
Phase One . . . . .	33
Phase Two . . . . .	34
Phase Three . . . . .	37
Phase Four . . . . .	38
III RESULTS . . . . .	39
Limitations of the Study . . . . .	39
Dropped Subjects . . . . .	40
Hypotheses . . . . .	40
Exploratory Questions . . . . .	47
IV DISCUSSION . . . . .	60
Exploratory Questions . . . . .	63
Suggestions for Future Research . . . . .	68
LIST OF REFERENCES . . . . .	70
APPENDIX	
A FORMS . . . . .	79
B STANDARD INSTRUCTIONS . . . . .	90
C TESTS . . . . .	95
D LETTERS . . . . .	105
BIOGRAPHICAL SKETCH . . . . .	108

# LIST OF TABLES

Table		Page
1	Means, Standard Deviations, and the Analysis of Variance Summary for the Change in Systolic Blood Pressure Among Groups X, Y, and C . . . . .	41
2	Results of Tukey Multiple Comparison Test of Significance of Mean Systolic Blood Pressure Change Between Groups X and Y, X and C, and Y and C . . . . .	41
3	Means, Standard Deviations, and the Analysis of Variance Summary for the Change in Diastolic Blood Pressure Among Groups X, Y, and C .	42
4	Results of Tukey Multiple Comparison Test of Significance of Mean Diastolic Blood Pressure Change Between Groups X and Y, X and C, and Y and C . . . . .	42
5	Means of Groups X and Y on Systolic Blood Pressure Measures Over the Six-Week Treatment Period . . . . .	45
	Means of Groups X and Y on Diastolic Blood Pressure Measures Over the Six-Week Treatment Period . . . . .	45
6	Means, Standard Deviations, and Analysis of Variance Summary Table for Scores on the I-E Scale Among Subjects in Group X, Group Y, and Group C as Achieved During the Posttesting Session . . . . .	47
7	Means, Standard Deviations, and Analysis of Variance Summary Table for Scores on the Hy and D Scales of the MMPI Among Groups X, Y and C as Achieved During the Posttesting Session . . . . .	48
8	Chi-Square Analysis for Experimental and Control Groups on Projective Drawing Ratings . .	49

Abstract of Dissertation Presented to the Graduate Council  
of the University of Florida in Partial Fulfillment of the  
Requirements for the Degree of Doctor of Philosophy

LEARNED SELF-REGULATION OF ARTERIAL HYPERTENSION  
UTILIZING BIOFEEDBACK AND RELAXATION TRAINING

By

Jacqueline Zurcher-Brower Orlando

August, 1974

Chairman: Robert Stripling

Major Department: Counselor Education

This study investigated the effects of biofeedback (electromyograph) and relaxation training on the blood pressures of individuals with chronic essential hypertension. One aim was to illuminate any differences between the effects produced by two treatment schedules. A second goal was to probe various personality characteristics which are associated with increased self-regulation. A third purpose was to explore the subjects' responses to the procedure in order to develop a clinically efficient treatment, study the reported changes in the subjects' coping strategy and life styles, and clarify the psychological process whereby the physiological changes occurred.

Thirty individuals with chronic essential hypertension were assigned to one of two experimental groups or to a control group for a six-week period. One experimental subgroup, Group X, was scheduled to participate in four biofeedback sessions per week in a hospital setting. The other experimental group, Y, received one biofeedback session per week. The

control group, C, received no biofeedback and no relaxation training as part of the study, and were told that they would receive biofeedback and relaxation training at the completion of the treatments of the subjects in Groups X and Y. In addition, subjects in Groups X and Y were to complete a session of autogenic training and progressive relaxation outside of the laboratory once a day on days that they received biofeedback and twice on the days when no biofeedback session was scheduled.

The results indicated that the treatment received by Group X was not statistically significant in reducing systolic blood pressure but was significant at the  $<.05$  level in reducing the diastolic blood pressure. The mean systolic decrease of Group X was 4.2 mm Hg and the mean diastolic decrease was 1.5 mm Hg. In contrast, Group Y sustained systolic and diastolic blood pressure decreases that were statistically significant at the  $<.05$  level. Group Y showed a mean decrease of 6.3 mm Hg in systolic measures and 9.5 mm Hg in diastolic measures.

Three licensed physicians evaluated the outcome and concluded that the treatment received by Group X failed to produce sufficient reduction in blood pressures to be clinically significant. However, the treatment received by Group Y did produce clinically significant decreases and was judged to have practical usefulness in the reduction of essential hypertension.

Participation in the experimental treatment failed to produce personality changes that were statistically significant at the .05 level as measured by the Internal-External Scale, the Draw-A-Person test, and the Hy and D scales of the Minnesota Multiphasic Personality Inventory.

In general, the subjects had few complaints concerning the treatment procedure, said they felt better, and reported that they had more desirable behavior patterns as a result of participation in the study. In addition to changes in blood pressure, subjects said they had fewer headaches, less insomnia, reduction in allergic reactions, decreased smoking and alcohol consumption, less prescribed medication and less nail-biting. They said that they increased in the ability to tolerate "stress," to avert tension in the skeletal muscles, and to alleviate lower back pain. Several subjects reportedly improved interpersonal relations, achieved greater sexual satisfaction, and gained a more tolerant attitude toward self and others.

The majority of the subjects said they achieved skeletal muscle relaxation following increased awareness of the kinesthetic sensation of tension, combined with the passive suggestion of autogenic phrases like "limp" and "heavy." Other subjects reported they achieved a relaxed state by having a "blank" mind.



## CHAPTER I

### INTRODUCTION

The concept of feedback is as old as the earliest form of biological evolution and is found at all levels of organization, from intracellular processes to social communication. The term "feedback" is of relatively recent origin, coined by pioneers in radio in the early 1900's [Karlins and Andrews, 1972]. Mathematician Norbert Wiener [1971] describes feedback as a method of controlling a system by reinserting into it the results of its past performance.

In psychotherapy the use of informational feedback is a central component, and its use is increasing with the emergence of many new treatment approaches. Behavior therapy; sensitivity, encounter, and Gestalt group therapies; and the video therapies, as well as training models for therapists, all make available to the patient some forms of augmented feedback that provides the means whereby he can gain new awareness about his own behavior [Lazarus, 1967; Rogers, 1951; Perls, 1969; Campbell and Dunnette, 1968; Carkhuff and Berson, 1967]. The informational feedback exists in a variety of forms such as the reactions of others to the patient's feelings and actions and the behavior manifested in the video-tape replay of patient-therapist interaction.

In a similar way, more refined techniques are being developed for providing an individual with feedback for specific internal bodily processes which enables one to modify what were once considered involuntary, or autonomic functions such as penile erection [Laws and Rubin, 1969]; heart rate [Hnatiow and Lang, 1965], brain waves [Kamiya, 1969], urine formation [Lapides et al., 1957], salivation [Frezza and Holland, 1971], and blood pressure [Moeller and Love, 1972]. Once a person can "see" his heartbeats or "hear" his brain waves, he has the information he needs to begin to control them. Depending upon the theoretical bias of the experimenter, the knowledge of results may be viewed as reinforcement, as in the operant conditioning paradigm, or as information. Regardless of the framework used to describe the process, the introduction of the psychophysiological feedback loop makes possible voluntary control over a variety of physiological events. This process serves as an added tool for the professional counselor to use in helping the individual take responsibility for his own behavior and its consequences. The current developments in methodology for enhancing voluntary control of internal states is perceived by many writers to be of importance [Mulholland, 1973; Hart and Tomlinson, 1970; Davidson and Krippner, 1971]. Such techniques enable man to identify his organismic needs and move from environmental support toward self-support.

The psychophysiological feedback principle, commonly called "biofeedback," is something like an internal mirror.

Its core lies in the detection of a physiological event and the conversion of the event into an electronic signal so that the subject can be immediately and continuously aware of the relative level or intensity of the event. Awareness of the psychological state associated with the variation in level makes possible the indirect control of the physiological event itself as the individual learns how the sensation and the event are related within himself. For example, as an individual becomes aware that his arm is feeling heavier and warmer due to vasodilation, he is being informed through the biofeedback apparatus that the muscle motor units are firing less often and the muscles in his arm are becoming increasingly relaxed [Basmajian, 1963].

The utilization of biofeedback in clinical practice requires an understanding of the interrelationships that exist between and among bodily functions and psychological states, with each individual viewed as a unique entity, differing from all others in autonomic specificity [Swartz, 1973]. Situations may evoke different patterns of response in each person [Lacey, 1967; Lang, 1970]. With regard to complex states such as anxiety and fear, it becomes important to determine what patterns of functions occur in the individual patient. Feedback must be selected and scheduled so as to optimize its integration with the problem in question, thus enhancing its therapeutic value.

This study will examine the effects of a biofeedback relaxation-training therapy when used with patients having

chronic elevated blood pressure of unknown etiology called "essential hypertension." Recently, essential hypertension has been brought to the attention of the public as a complex and dangerous condition which can shorten life significantly. It apparently results, in many cases, from the interaction of the person and his environment, together augmenting or producing the bodily dysfunction [Pickering, 1968]. Antihypertensive drugs are effective for some. For others, treatment with drugs is not satisfactory in that the hypertension fails to be reversed or the drugs produce undesirable side effects. A procedure not requiring the use of drugs, or as an ancillary treatment to drug therapy, is needed [Pickering, 1968; Datey et al., 1969].

### Review of the Literature

During the last ten years, an increasing number of articles on the topic of operant conditioning and establishment of self-control of cardiovascular processes in humans has appeared in the literature. Swartz [1973] reported that over 250 papers had been published on the use of operant feedback techniques in the control of physiological processes. The Aldine Press has reprinted much of this work in four volumes, with an additional volume planned for each succeeding year [Barber et al., 1971; Kamiya et al., 1971; Stoyva et al., 1972; Shapiro et al., 1973]. Blanchard and Young [1973] reviewed the research in the area of operant conditioning or self-control of four cardiac functions, heart rate level,

heart rate variability, blood pressure, and cardiac arrhythmias.

The purpose of this survey of the literature is to review alternatives to drug therapy in the control of blood pressure, particularly with the combined use of relaxation training and biofeedback in human subjects. As the literature suggests, the application of learning concepts such as differentiation and reinforcement enables the counselor to assist an individual in regulating his internal behavior. By becoming aware of the psychophysiological process involved in producing an undesirable physical condition, one can choose not to produce the condition in one's self. Currently, behavioral and humanistic counselors and psychologists are developing clinical treatment programs for tension and migraine headaches, insomnia, subvocalization, cerebral palsy, epilepsy, Raynaud's disease, and contraception [AHP, 1973].

#### Relaxation Training as a Method of Self-Regulation of Some Cardiac Functions

The use of progressive relaxation, as developed by Jacobson [1938], and the use of various Yoga exercises [Datey et al., 1969] and other forms of meditation have produced a significant degree of change in cardiac and related functions. In 1939 Jacobson reported the effects of training on blood pressure. His relaxation process focused on the relaxation of various sets of muscles in a systematic manner until the entire system was relaxed. He concluded that there is a general relationship between decreases in blood pressure and decrease in muscle activity, as shown by the electromyogram, and that

training in progressive relaxation results in greater decreases in electromyogram activity than self-induced relaxation without training.

Paul [1969] reported on physiological changes in college-age females who were treated with (1) a brief form of progressive relaxation training, (2) hypnosis induction and suggestions on relaxation, or (3) self-instructed relaxation. The progressive relaxation group showed significantly greater changes in heart rate than the other two groups.

Datey et al. [1969] combined muscle relaxation with breathing exercises in treating 47 hypertensive subjects. A specific Yoga technique called "Shavasan" was employed which enabled the subject to become increasingly alert inwardly and less conscious of the external environment, thus facilitating greater relaxation. Datey reported that in Group I (10 patients) who took no drugs, the average mean blood pressure of 134 mm Hg was reduced to 107 mm Hg, an average reduction of 27 mm Hg. This was statistically significant at the .05 level. In Group II (22 patients) who were controlled with drugs, the average mean blood pressure was 102 mm Hg and was not reduced. For the 15 patients in Group III whose blood pressure was not adequately controlled by drugs, a reduction in average mean blood pressure from 120 to 110 mm Hg occurred.

Schultz and Luthe [1969] attempted to aid subjects in becoming more aware of their proprioceptive sensations in addition to increasing muscle relaxation. These authors



formulated a series of specific exercises which develop muscle relaxation and increase peripheral blood flow and reactive vasodilation in the subject. The approach, called "autogenic therapy," was utilized with a group of hypertensives by Klumbies and Eberhardt [1966]. Blood pressure readings were taken at various intervals during the four-month study. The greatest decrease in systolic and diastolic pressures occurred in the first month of training and was attributed to the effects of the autogenic training.

Although many claims of phenomenal degrees of self-control among Yogis had been made, few data were collected until Wenger and Bagchi [1961] made autonomic recordings from over 50 Yogis in India. They concluded that changes in blood pressure and cardiac functioning were due to vagal innervation, not through control of striated muscle.

Wallace [1969] studied the effects of transcendental meditation, as taught by the Maharishi Mahesh Yogi, and found an average decrease of five beats per minute in five subjects who were measured for heart rate. In a later study, Wallace et al. [1971] found significant changes in electroencephalogram and oxygen consumption in transcendental meditators, comparing the meditation period with the 30 minutes preceding.

These studies suggest that autogenic training, progressive relaxation, Yoga, and other forms of exercise meditation can have important clinical application in the field of self-regulation. They indicate that certain bodily functions such as brain waves, oxygen consumption, and some cardiac functions

may be regulated through changes in muscle tension and respiration.

### Feedback Training as a Method of Self-Regulation of Blood Pressure

Information feedback as well as such reinforcers as food and pleasurable stimulation has been used by researchers to enable subjects to learn to regulate their electrodermal, electroencephalographic, and electromyographic activity [Shapiro and Crider, 1967; Kamiya, 1969; Basmajian, 1963]. Numerous bodily processes, previously considered to be involuntary, such as salivation [Brown and Katz, 1967; Frezza and Holland, 1971], heart rate [Engel and Melmon, 1968; Hnatiow and Lang, 1965], and certain vasomotor responses [Snyder and Nobel, 1967] have been brought under the control of the subject.

### Direct Control of Blood Pressure Through Instrumental Conditioning

The application of biofeedback to the control of blood pressure requires the use of a suitable blood pressure measurement and feedback system. Because direct measurement of pressure requires the surgical insertion of a pressure-transducing tube into an artery, such a means of measurement is impractical for routine research with human subjects. It has been demonstrated, however, that systolic blood pressure responses can be conditioned directly. Di Cara and Miller [1968], working with rats, used direct measurements and feedback. The question as to whether humans could also learn to



raise or lower their systolic blood pressure, using biofeedback, was approached by Shapiro et al. [1969,1970]. Using normotensives with an indirect measurement procedure, he demonstrated that subjects reinforced for systolic blood pressure increases were able to raise or maintain their pressure, while subjects reinforced for decreases in systolic pressure were able to lower their pressure.

The Shapiro research raises the issue as to how the subjects produced the change. Did change occur as a result of somatic meditation or cognition, or had operant conditioning of autonomic activity per se taken place? Miller [1961] emphasized that this issue is of central importance in understanding the neurophysiology of learning. Katkin and Murray [1968] reviewed a number of studies that attempted to demonstrate instrumental conditioning of autonomically mediated behavior. They concluded that the Miller group convincingly demonstrated the phenomenon with animals. Some work with human subjects [Johnson and Swartz, 1967; Snyder and Noble, 1968] demonstrated such conditioning "in a manner difficult to criticize" [Crider et al., 1969].

The Shapiro study, as well as others, has provided normotensive subjects with biofeedback of their blood pressure which led to statistically significant changes in blood pressure, but these changes were not sustained outside the experimental setting without the biofeedback [Benson et al., 1971; Brener and Kleinman, 1970].

### Indirect Control of Blood Pressure Using Deep Relaxation

When the work of Lisina [1965], who was reported by Razran [1961] to have conditioned vasodilation instrumentally in the Soviet Union, was published in English, it appeared that she did not claim to have conditioned vasodilation directly. Lisina concluded that her subjects were able to gain voluntary control over their blood vessels by "using a number of special devices, mainly the relaxation of the skeletal musculature and changing of the depth of respiration" [1965, p. 456].

In the United States, Harrison and Mortensen [1962] were the first to demonstrate that the individual motor units in the skeletal musculature could be voluntarily controlled through the use of a biofeedback system. A motor unit fires when an impulse reaches the muscle fibers. Accompanying the impulse is an electrical potential which, when recorded, is known as the electromyogram. Basmajian [1963] has extended the previous finding and demonstrated that subjects can acquire quite subtle control over individual motor units. He observed that when subjects learned such specific control, they were able to produce "various gallop rhythms, drum-beat rhythms, and roll effect" [p. 341].

Attempting to induce deep relaxation in humans, Green et al. [1969] trained subjects to achieve zero firing in large forearm muscle bundles. The results indicated that 7 of 21 subjects were able to achieve the criterion of zero

firing within 20 minutes, and they were able to maintain it for 30 minutes or more.

Budzynski and Stoyva [1969] and Budzynski et al. [1970] conducted studies demonstrating feedback control of the frontalis (forehead) muscles and showed that by relaxing this group of muscles, a person could alleviate tension headaches. They obtained results demonstrating that the feedback group evidenced much greater relaxation than the no-feedback and irrelevant-feedback control groups. The changes in the laboratory were apparently generalized to everyday life, with subjects making comments which indicated a heightened awareness of maladaptive rising tension, an increasing ability to reduce tension, and a decreasing tendency to overreact to stress [Budzynski et al., 1970, p. 210].

#### The Moeller and Love Research Study; Techniques, Design, and Outcome

Reasoning that the altered blood pressures in the Shapiro [1969], Benson et al. [1971], and Brener and Kleinman [1970] studies were not sustained because the human awareness to sense directly blood pressure level is not very well developed, Moeller and Love [1972] sought to devise a technique directly conditioning a concomitant physiological function for which the human body already possessed an efficient set of proprioceptors. Using muscle tension as a physiological concomitant for blood pressure, Moeller and Love [1969] used electromyographic, biofeedback training in conjunction with an adaptation of Schultz and Luthe's autogenic

exercises and obtained a decrease in both systolic and diastolic blood pressures. Moeller [1973] further investigated conditioning muscle relaxation as a concomitant for blood pressure, using a treatment regimen similar to that used in his first study. Again, using hypertensive subjects, he examined the relationships among the variables of muscle tension and systolic and diastolic blood pressure during and following the treatment. Based on this researcher's review of the literature, it appears that the Moeller study is the exception to the criticism leveled by Blanchard and Young [1973] who concluded that the self-control of cardiac functioning is, for the most part, a "promise as yet unfulfilled." Blanchard and Young's recent review indicated that (1) changes in cardiovascular functioning were studied, for the most part, in normal subjects instead of patients, and (2) the magnitude of change was related to a statistically significant rather than a clinically significant magnitude.

Miller had criticized the earlier Moeller and Love study [1972] for their use of each subject as his own control. The second Moeller study, discussed more fully below, utilized both a control group and matched pairs as well as an increased number of subjects, thus achieving a more defensible design for studies of this nature. Compared with the work of Shapiro and his colleagues at Harvard and Brener and Kleinman, the techniques devised by Moeller and Love require longer training but appear to be as efficient in the

reduction of the systolic value and superior in the reduction of the diastolic value. Moeller's second study showed a mean decrease of 12 mm Hg for the diastolic and 14 mm Hg for the systolic blood pressures in their pooled treatment groups. The largest diastolic decrease in the summary of research presented by Blanchard and Young [1973] indicated a -2.0 mm Hg mean reduction by Shapiro et al. [1972], and Brener and Kleinman [1970] reported systolic decreases of -16 mm Hg.

Moeller's use of a control group showed that the decrease in blood pressure was not due to the habituation of the subjects to the experimental surroundings. In addition, the subjects were not differentially affected by the five individuals who conducted the treatment. Although previous research demonstrated that blood pressure can be lowered, one of the main contributions of the Moeller work is that the lowered blood pressure response seemed to generalize outside the experimental setting. This would indicate that feedback of a concomitant physiological function (muscle tension) obtained a sustained reduction in blood pressure, whereas the direct blood pressure feedback used by previous investigators did not.

Moeller has suggested that the decrease in blood pressure is due, in part, to the subjects becoming less tense during periods of stress; thus, the learning of deep muscle relaxation may be generalizing itself to other situations. He speculated that the significant decrease in diastolic pressure may indicate that the peripheral resistance was

reduced and the arterioles of the subject may have become less resistant to the passage of blood. With the tone of the skeletal muscles considered a voluntary function and the smooth, arteriolar muscles, involuntary, Moeller suggested that both the voluntary and involuntary functions are merely correlated measures with the mediating link yet undetected. Since physicians are more interested in decreasing the diastolic level which is related to peripheral resistance [Merrill, 1966], the significance of the diastolic decrease may also indicate that the Moeller-Love relaxation procedure is of clinical value as an ancillary to other methods presently being used.

Another issue explored by Moeller was that of the cause of the decrease in systolic blood pressure produced by relaxation training and a biofeedback approach. Does muscular relaxation cause lowered pressure, or does a modification occur in the sympathetic nervous system which causes the lowered blood pressure? Or are these phenomena one and the same? Prior to Moeller's second study, little was known regarding the temporal effects of muscular relaxation and blood pressure. He found that the highest correlation between EMG change lagged two measurement periods (weeks) behind blood pressure, tending to indicate that blood pressure change was most greatly associated with the EMG change that had taken place two weeks previous. Hypothetically, any changes of the EMG measurements between sessions will be most highly correlated with the variables of blood pressure two weeks later, with the benefits of the EMG training



maximized at that time. This phenomenon tends to support Gelhorn's [1970] postulate that modification of the hypothalamic activation occurs through muscular relaxation and lowered cortical arousal.

In the Moeller study, subjects were assigned randomly to one of three treatment groups for a four-month period. The amount of biofeedback and relaxation exercises scheduled varied among groups. A fourth group served as a control group, receiving two laboratory sessions per week for four weeks, without feedback regarding their muscle tension, and did not receive relaxation exercises to do at home.

In using a multivariate analysis of covariance to examine the differential effects of the variation among treatment groups, an assumption was made of linearity in reduction of blood pressure. While analysis of covariance takes into account any difference among groups on the criterion variables and, accordingly, adjusts the post-treatment means of the criterion variables, this statistical procedure is not appropriate should it become more difficult for subjects to reduce blood pressure as the blood pressure level approaches the normal range. The data analysis showed no significant differences between the treatment groups; however, the initial difference between the means of the groups was sizable. This could, with a curvilinear relationship, fail to show a difference among groups when, in fact, differences attributable to the varied treatment schedules did exist. While

raised in the Moeller study, the question of the effect of different schedules in treatment has not been adequately answered.

### Summary of the Review of Literature

The literature reviewed above suggests that elevated blood pressure of unknown etiology can be reduced through relaxation training. While it has been demonstrated that blood pressure can be conditioned directly through the use of reinforcement in the laboratory, the reduction cannot be sustained. The relaxation training method comprised of biofeedback of muscle tension, autogenic techniques, and the progressive relaxation approach appears to generalize outside of the training sessions and permits a sustained reduction in blood pressure.

### Psychological States Associated with Self-Control and Instruments of Assessment

Often there seems to be a change in one's psychological state concurrent with biofeedback training [Davidson and Krippner, 1971]. Many authors such as Kamiya [1969], Green et al. [1970], and Honorton et al. [1971], have stated that some of their subjects enter into altered states of consciousness during training of this kind. In this sense, the biofeedback paradigm appears to create a closed system in which the individual uses volition to control his physiological processes in the human situation. Green et al. [1970]



stated that "it is not possible to define in an operational way the meaning of the word 'voluntary,' but all of us have a feeling of voluntary control, at least part of the time. . ." [p. 3]. In the training situation, this feeling of voluntary control is important, because the subject experiences himself as the locus of control. He is the agent of change, and only through an act of his own choice is he able to demonstrate control over his own internal states.

#### Measurement of Feelings of Volition

This type of self-control would seem to enable people to become less subject to external control and manipulation and more inner-directed. Maslow [1962] described one of the characteristics of the self-actualized person as being able to resist rubrication. . With the application of biofeedback techniques, one may move toward becoming more resistant to certain cultural biases and forms of societal conditioning [Davidson and Krippner, 1971]. The significance of the belief in fate, chance, or luck has been discussed by various social scientists over a long period of time. As early as 1899 Veblen wrote that a belief in luck or chance represented a barbarian approach to life and was generally characteristic of an inefficient society. More recently, Merton [1946] discussed the belief in luck as more or less a defense behavior, as an attempt to serve the psychological function of enabling people to preserve their self-esteem in the face of failure.

In the field of psychology, White [1959], in discussing an alternative to drive reduction, noted how the work of many authors has converged on a belief that it is characteristic of all species to explore and to attempt to master the environment. Angyal [1941] noted also the significance of the organism's motivation toward autonomy, or the active mastery of the environment.

The first attempt to measure individual experiences in a generalized expectancy or belief in external control as a psychological variable was by Phares [1965]. The James-Phares scale was broadened and further developed by J. B. Rotter [1966]. He hypothesized that this variable is of major significance in understanding the nature of learning processes in different kinds of learning situations, and also, that consistent individual differences exist among individuals in the degree to which they are likely to attribute personal control to reward.

When a person believes that something occurs following some action of his own but is not entirely contingent upon his action, Rotter [1966] has labeled this event as a belief in "external control." If the person perceives that the event is contingent upon his own behavior or his own relatively permanent characteristics, this is termed a belief in "internal control."

This study utilized the Rotter Internal-External Scale (I-E Scale) in an attempt to examine the relationship between locus of control and amount of reduction in blood pressure.

It is recognized that Rotter's definition and use of "internal control" is not all that may be included in describing the experience of personal causation or a feeling of freedom; however, among the tests in print, the I-E Scale appears to measure a similar quality. In addition, the difference in the scores of subjects who receive biofeedback and relaxation training and those who do not was investigated on the internal-external dimension.

The I-E Scale is a forced choice, 29-item test in which the subject reads a pair of statements and indicates with which of the statements he agrees more strongly. The scores range from 0 (the consistent belief that individuals can influence the environment and that rewards come from internal forces) to 23 (the belief that all rewards come from external forces). Rotter [1966] describes the groups upon which the test-retest reliability was based. The elementary psychology student sample used in one of Rotter's standardizations appears to be most like the subjects in this study, compared with the other samples he describes. In a one-month retest with group administration, the elementary psychology student sample produced a reliability coefficient of .72. Rotter [1971] described a listing of references using the I-E Scale in excess of 300, including the well-known Coleman "Report on Equality of Educational Opportunity." As in the Coleman report, the clinical version was used rather than the research version, for its single score and ease in interpretation.

### Psychological Changes Associated with Self-Regulation

Green et al. [1969] trained subjects to achieve zero firing in large forearm muscle bundles. They reported that five of the seven subjects who achieved zero firing rapidly and sustained it for 30 or more minutes commented that they had experienced body image changes. In addition to the change in proprioceptive and internal sensations resulting from the treatment, the change in feelings toward one's self may be affected by the training process [Lesh, 1970; Jacobson, 1957; Assagioli, 1965].

The Draw-A-Person (D-A-P) was selected for this study to explore potential body image changes associated with the treatment process. This method of measuring change in body image was developed by Machover [1948,1951]. She reported that her modification of the D-A-P, originally devised by Goodenough [1926], can be used projectively to assess those aspects of psychodynamics involved with the self-image and with body-image. Her assertion was supported by Luthe [1963] who reported that by using the Drawing-Completion Test he observed a characteristic pattern of projective changes; such as progressive differentiation of the projective responsiveness, increase of output, more shading, elaboration of details, stronger pressure of lines, increase of dynamic features, better integration and composition of the drawings, less rigidity, fewer inhibitions, faster performance, and better adaptations to the different stimuli. He further stated that

corresponding changes have been observed in the D-A-P; however, the research is not available in English [Luthe, 1958].

The literature on projective techniques links the term "projective" with the psychoanalytic mechanism of projection, as well as the dictionary sense of the word, namely, to project (as a cartographer might project) an almost physical extension of psychological attributes [Wolman, 1965]. From Lowenfeld's work [1947] it appears that there are basic differences among individuals with respect to the predominance of (1) the projection of body needs and conflicts and (2) the role of visual, objectively determined stimuli in the formation of the subject's body image. If so, the product cannot be interpreted in the same manner for all individuals. In the Lowenfeld study, each subject was used as his own control.

The Machover method involves a careful and detailed examination of both the content and the structural and formal aspects of the drawing, considering the absolute and relative size of the figure, placement on the page, symmetry, perspective, type of line, shading, and erasures. In evaluation, considerable attention is paid to the overall mood or tone conveyed by the figure through facial expression and postural attitude.

#### Measurement of Psychological State Changes

Many writers [Bibring, 1953; Alexander, 1939; Hill, 1935] related psychological states such as depression and

hypochondriasis with physical disease or disorders. Budzynski et al. [1970] stated that patients, after completing the training program, reported (1) a heightened awareness of maladaptive rising tension, (2) an increasing ability to reduce such tension, and (3) a decreasing tendency to overreact to stress. His work suggests that the subjects increased feelings of self-control will generalize into their everyday life, should they increase feelings of self-control.

This study explored the relationship between reduction in blood pressure through learned self-regulation and the level of depression and hypochondriasis as measured by two scales on the Minnesota Multiphasic Personality Inventory (MMPI). The MMPI is a widely-used, well-standardized instrument designed for personality assessment [Hathaway and McKinley, 1951]. It is comprised of 550 statements covering a wide range of subject matter, from the physical condition to the morale and social attitudes of the individual being tested. The subject is asked to sort the statements into three categories: true, false, and cannot say. His responses yield scores on four validity scales and nine clinical scales. The original normative data were derived from a sample of about 700 individuals representing a cross-section of the Minnesota population as obtained from visitors to the University Hospital. In this researcher's opinion, the sampling was adequate for the ages 16 to 55 and for both sexes. The scales were developed by contrasting the normal groups with carefully studied clinical cases of which over 800 were



available from the neuropsychiatric division of the University Hospital. The chief criterion of excellence was the valid prediction of clinical cases against the neuropsychiatric staff diagnosis, rather than statistical measures of reliability and validity. A high score on a scale has been found to predict positively the corresponding final clinical diagnosis or estimate in more than 60 percent of new psychiatric admissions.

In considering the question of reliability, the characteristics of the particular population needs to be considered, as well as the range of scores within the population. No data are available on the reliability of the test for non-hospitalized individuals with essential hypertension. The reported test-retest reliabilities range from .46 to .91 with normals (covering the basic scales) over a period of from three days to one year, and cluster about a median of .76. Gynther and Rogers [1959] consider the MMPI to be the most carefully constructed and thoroughly researched inventory available for personality assessment.

#### Descriptions of Certain Psychological Processes Associated with Increased Self-Regulation

Few writers have explored the psychological states associated with electromyographic changes. Murphy [1969] stated that our language fails to provide labels for many of our internal processes. He wrote that the feeling, cognitive, and volitional states will lead to alterations in

states of consciousness, well-known to the East, upon which "human destiny almost literally may depend" [p. 523]. An open-ended interview at the conclusion of the treatment provided the subjects with an opportunity to describe their own subjective experiences during the treatment period. The interviewer recorded the verbal behavior of the subject during the termination interview. A summary of the data is presented in the chapter reporting results of this study.

Within the interview itself, an interview technique, described by Kahn and Campbell [1966], was utilized, which combined Roger's "reflection of feelings" with the use of specific questions in order to assist the subject in clarification of his own response and attitude toward aspects of his participation which he will not have thought much about.

The primary focus of the research was upon the effectiveness of learned self-regulation in the reduction of essential hypertension. Previous research literature seems to suggest the importance of understanding the subjective experience of the subject and the psychophysiological mediation process. The scope of the study included an exploratory investigation of the latter.

#### Equipment Utilized in the Study

A portable EMG feedback system built by Bio-Feedback Systems, Inc., Boulder, Colorado, was used to provide



electromyographic information to the subjects. The equipment was made available to the experimenter through the Department of Clinical Psychology, University of Florida, and is considered to be suitable for its intended purpose by Love [personal communication, 1973], a researcher in the clinical use of biofeedback at Nova University. According to the manufacturer, model PE-2 is designed to provide accurate and meaningful feedback of surface EMG levels as low as 2 microvolts. The PE-2 fulfills all of the requirements of an EMG-sensitive, noise-insensitive device. The electrode leads are housed in a low-noise cable, the pre-amplifier has a high input impedance and high common-mode rejection, a sharp high-pass filter removes signals below 95 Hz, and the equivalent noise generated by the pre-amplifier semi-conductors is quite small, 2 microvolts peak to peak. When the battery level fell below an acceptable level of output, new batteries were installed.

Auditory feedback is provided in the form of a series of clicks. The repetition rate of the clicks is proportional to the EMG level. Thus, as the EMG level rose, the click rate increased. The frequency of the clicks can vary from below 1 per second to approximately 100 per second. The subject is instructed to produce a slow click rate, signifying a low EMG level. The experimenter recorded the visual meter reading at one-minute intervals throughout the biofeedback session.

A KTK brand cuff sphygmomanometer and Littman stethoscope were used in blood pressure measurement.

### Purpose of the Study

Advances in technology and the appropriate application of learning theory make it possible to explore needed therapy approaches for the treatment of those afflicted with essential hypertension (elevated blood pressure of unknown etiology). The significance of this study is noted when one considers the impact of chronic hypertension on the quality and duration of the life of an individual. Sustained blood pressure elevation often becomes associated with cardiac, cerebral, and renal functional impairments, as well as vascular complications. Drug therapy is often an unsatisfactory approach in handling the subject in treatment as indicated previously.

The purpose of this study is to assess the effectiveness of a psychophysiological approach, biofeedback relaxation therapy devised by Moeller and Love [1972], for the reduction of blood pressure in subjects with chronic essential hypertension.

The Moeller study [1973] utilized a four-month treatment schedule, in contrast to this treatment schedule which is applied on a short-term, six-week basis. In addition to comparing the effectiveness of two 6-week treatment schedules in reducing blood pressure, the study examined the subjective responses of the subjects to the treatment procedure and the perceived changes within themselves as a result of the treatment. Obtaining such information did assist in making further clinical refinements in the therapy approach.

The literature indicates that the Moeller-Love treatment surpasses any other nonpharmacological treatment for essential hypertension in terms of the following clinical considerations: (1) amount of decrease in systolic and diastolic blood pressure, (2) generalization outside of the experimental setting, and (3) feasibility for use in a clinical setting. In working toward greater efficiency in treatment, it is important to determine the changes produced by different treatment schedules and to observe the reactions of the subject to the treatment procedure as well as to the changes he perceives as a result of the treatment.

### Hypotheses

- 1A. There will be no significant difference in changes on blood pressure measures among Groups X, Y, and the control group, C.
- 1B. There will be no clinically significant difference in changes on blood pressures among Groups X, Y, and the control group, C.
2. There will be no significant relationship between the scores of subjects in the treatment groups on the I-E Scale and amount of reduction in blood pressure.
3. There will be no significant difference among scores on the I-E Scale achieved by subjects in Groups X, Y, and C.

### Exploratory Questions

1. Do scores on the Hy and D scales of the MMPI differ between the subjects in Groups X and Y as compared with Group C, at the conclusion of treatment?

2. Will ratings of positiveness of body image as measured by the D-A-P test differ between Groups X and Y compared with Group C at the conclusion of treatment?
3. What aspects of the treatment affect the subject in a negative manner?
4. Does self-regulation of blood pressure affect the way in which a person views his external environment with respect to his coping strategy of life style?
5. How does a subject describe the psychological process by which he effects muscle relaxation?

## CHAPTER II

### DESCRIPTION OF THE STUDY

#### Methodology

In order to assess the effectiveness of a biofeedback and relaxation training approach devised for the reduction of blood pressure in hypertensive individuals, 30 subjects were selected from a group of screened volunteers and assigned to one of three groups for the duration of the study. Groups X and Y received relaxation exercises to be done twice daily outside of the treatment laboratory. In addition, Group X received biofeedback four times weekly, and Group Y, once weekly. Group C, serving as a waiting-list control group, participated in the pre- and post-measures, but received no biofeedback sessions nor relaxation training. All subjects continued prescribed drug therapy. The data collected on subjects for whom the dosage was increased or changed in kind were not included in the statistical analysis related to the hypotheses, but are presented in the final chapter, where the broader aspects of the study are discussed. These subjects were allowed to continue in the treatment if they wished to do so. If the dosage was reduced or discontinued, the subject remained as part of the study.

Group C was told that their treatment procedure would be undertaken at the completion of the treatment of subjects in Groups X and Y. One limitation of the study was that subjects in Group C may have viewed themselves as though they were on a waiting-list, rather than in a no-treatment group. The effect of this status upon the subjects was not determined. It is the opinion of this researcher that the expectation of no treatment following the sessions of baseline measurements and pretesting would be a source of frustration to the subjects. The literature suggests that hypertension may be related to emotional stress [Harris et al., 1953]. In view of the existing hypertensive states of the subjects, it was desirable to assist the subjects in the maintenance of psychological comfort insofar as possible by providing the expected treatment. In addition to the preliminary baseline data-gathering sessions and treatment, postmeasures were made during the last week of treatment and in a termination session.

### Instruments

Two types of data were collected. The physiological measures of blood pressure taken with a cuff sphygmomanometer and stethoscope were made by trained examiners with no involvement in the outcome of the study. Their competency was approved by a licensed physician. The psychological measures and ratings were secured through scores achieved on Rotter's I-E Scale, the D-A-P, and scales Hy and D of the MMPI. The

contrast in the formats of the tests served to reduce the possibility of boredom. In addition, an information-gathering interview provided descriptions of the subject's subjective response to the treatment.

A psychologist examined the D-A-P drawings of each subject and judged whether the postdrawing, relative to the pre-drawing, appeared to reflect a more "positive" body image. The ratings were made blind, with the criteria listed previously for use in making the global judgement. This rating technique is a modification of the scoring technique employed by Machover. The I-E Scale and MMPI subscales were administered during the posttreatment session and scored according to the standard procedures for each test.

The termination interview was developed by the experimenter in order to assess the subject's response to participation in the study. An attempt was made to elicit the subject's feelings about the treatment procedure including the training via the tapes and the changes that may have occurred as a result of successful treatment. In addition, the subjects were asked to describe the process by which they achieved lowered muscle tension. The interview was taped with the subject's consent. Relevant excerpts were selected and summarized from the tapes.



### Subjects

The 30 subjects were selected from a pool of volunteers who had been diagnosed by their physicians as having essential hypertension and have been under treatment for that condition for one or more years. For the purpose of this study, hypertension was defined as having blood pressures above 140 mm Hg for the systolic value and 90 mm Hg for the diastolic value [Gressell, 1949].

The subjects were between 18 and 55 years of age. They were not psychotic, intellectually retarded, or obese, as determined by the referring physician and the experimenter. The subjects had been taking the same kind and dosage of drugs for a period of at least one month prior to the beginning of the study.

### Procedures

The location of the biofeedback laboratory was North Florida Regional Hospital in Gainesville, Florida. The hospital's Board of Trustees granted the use of adequate space to the investigator. The setting was considered appropriate for the study, as it was air-conditioned, quiet, accessible, and private.

The study was conducted in a manner consistent with the standards set forth for research with human subjects by the American Personnel and Guidance Association, the American Psychological Association, and the Committee for the Protection



of Human Subjects at the J. Hillis Miller Health Center, University of Florida, Gainesville [Clark, 1967; AGPA, 1961; APA, 1963; Schultz, 1969]. The first phase of the study included baseline measurement and testing, the selection of subjects, and assignment to a treatment or control group. The second phase was comprised of the actual treatment period. The third phase included posttesting, analysis of the data, and the exposition of the results of the study. The final phase was the period during which the subjects in the control group were given an opportunity to receive the biofeedback and relaxation exercises.

The following individuals were trained by the experimenter and provided assistance in the process of baseline measurement, treatment, and/or posttreatment measurements: Ms. Estelle Carson, Ms. Sue Edell, Mrs. Judy Foote, Ms. Tay Tanya, Ms. Paula Saraga, Ms. Lois English, and Mr. John Butter.

### Phase One

Each individual who volunteered to participate in the study was screened over the telephone regarding age, weight, and physical condition. If he or she seemed to be suitable prospects, an interview was scheduled for obtaining baseline data.

During the preliminary interview, the demographic form (Appendix A1) was completed and the "Explanation to Volunteers" (Appendix B1) provided by the experimenter. Following this, the subject was instructed to empty his bladder.

Returning to the laboratory, his blood pressure was measured by a trained individual who had no involvement in this study or its outcome. The competency of the individual to measure accurately blood pressure was determined by the judgement of a licensed physician. With the relaxation chair placed in a position midway between reclination and an upright position, the subject's left arm was placed horizontally at the level of the fourth intercostal and the cuff was inflated until the radial pulse disappeared, thus assuring a true measurement of the systolic pressure.

After completion of the initial interview and assessment of the pertinent data related to the selection of the subjects, 30 subjects were selected and scheduled for a second session. During the second session, the subjects were given the "Instructions for Subjects" (Appendix B2). As subjects completed the testing, they were introduced to the biofeedback equipment and laboratory. At the conclusion of the second preliminary session the subject was randomly assigned to Group X, Y, or C.

### Phase Two

The experimental procedure for the biofeedback session in the laboratory was based on the system followed by Love et al. [197 ]. Love's procedures represent an attempt to standardize the session in order to eliminate as much variation as possible, yet allow for personal interaction between subject and examiner. Each subject was greeted and conducted

to the experimental room. With the experimental chair in an upright position, the subject's systolic and diastolic blood pressure was taken three times, as previously described. The subject's forehead was cleaned with alcohol to remove any skin oil. Three EMG surface electrodes filled with Beckham electrode paste were placed approximately one inch apart over the frontalis muscle of the forehead. Earphones were placed on the subject's ears and the chair adjusted to the full reclining position. The subject was instructed to relax with his legs uncrossed and his arms on the arms of the chair.

At this time, the experimenter left the subject alone and went to the control room to monitor the subject's progress. The subject's EMG level was monitored for two of the initial trials without auditory feedback to establish a baseline at the beginning of each session. The auditory feedback was then switched on so the subject could hear his progress. He received four 5-minute trials with continuous feedback during which time he relaxed and attempted to reduce the quantity of auditory clicks. The mean of the final 10 minutes of feedback was recorded from the meter.

At the beginning of the first session, the loop gain was set on "low." When the subject achieved a mean score of approximately 20 microvolts per second for 10 minutes he was informed that the "gain" would be increased to "medium," making it more difficult for him to reduce his tension level to the previous low level. Likewise, when he achieved a mean

score of 20 microvolts on "medium," the "gain" was increased to "high" where it remained for the duration of the study.

The subject's blood pressure was measured and recorded. As the experimenter disconnected the subject from the apparatus, the subject was asked the questions listed on the form entitled "Conclusion Questions" (Appendix B3). Rather than discussing the affective reactions of the subject in an unstructured manner, this method was selected to minimize and standardize the amount of verbal interaction between the experimenter and subject. This procedure was followed for each scheduled session for the duration of the study.

After the first introductory session, the subject was given a tape cassette with relaxation exercises recorded on it and was told to practice twice per day at home or work, in a relaxed, reclining position, and once on the day that he was scheduled to receive feedback [Love and Love, 1973]. The tape consisted of instructions to alternately flex and relax the muscles of the arms, neck, face, and eyes. In addition, he was given a booklet in which to record his daily performance and feelings related to stress.

After two weeks the subject was given the second tape in the Love series, with instructions, and was told to practice as before. The second set focuses on the tension and relaxation of the foot and leg muscles and the muscles of the torso. Four weeks after the beginning of the study, the subjects in Groups X and Y were given a third set of exercises. The instructions for this

set were on a third tape cassette. These exercises integrate the first two sets and focus on total relaxation. This set of exercises was the last in the series and was practiced by the subject for the remaining two weeks of the study.

### Phase Three

Following the treatment period, the experimenter collected the posttreatment data. The D-A-P test, the I-E Scale, and the Hy and D scales of the MMPI were administered to each subject. After the test administration was completed, an interview was conducted by the investigator with subjects in Groups X and Y. The purpose of the interview was to assess the response of the subject to the treatment, the procedures, and the effect of the treatment on the subject, so that further modifications can be appropriately made in the future. The interview was tape-recorded.

O'Conner [1972] advised against the use of change scores of psychological test scores in his discussion extending classical test theory to the measurement of change. Likewise, Chronback and Ferby [1970] cautioned against the use of psychological change measurement. Therefore, a post-only comparison was made of scores on the MMPI subscales and I-E Scale. As explained earlier, it was necessary to use each subject as his own control in the D-A-P test, which was administered both pre- and posttreatment. The median or modal value of the blood pressure measures made during the final two treatment sessions was considered the postmeasure of

these variables for Groups X and Y. Group C was retested and measured during an additional session scheduled for that purpose.

#### Phase Four

The final phase of the study provided biofeedback and relaxation training exercises to those subjects in the control group, Group C. The subjects were given a choice of the treatment schedules used for Groups X and Y. At the time of this writing two control subjects have selected and completed the treatment schedule assigned to Group Y. Two control subjects are in the process of completing the Y treatment schedule. Four control subjects plan to begin the treatment schedule of their choice in September, 1974, and the remaining two have moved to other cities.



## CHAPTER III

### RESULTS

In general, the subjects in the two experimental groups reported that they felt better as a result of participation in the study. Approximately three-fourths of them achieved relaxation by autosuggestion of the desired state, using key words such as "limp" and "quiet." Criticism was minimal and usually focused on the amount of time required to participate and scheduling problems. While the mean blood pressure measures of the experimental groups were reduced both systolicly and diastolicly during the course of treatment, the effects of the change failed to be manifest on the selected personality tests when the scores of the experimental groups were compared with the control group.

#### Limitations of the Study

There were a few times when subjects missed biofeedback sessions. No subject missed more than 10% of his appointments. Whenever a subject did miss a scheduled appointment, the mean blood pressure measures from the previous appointment and from the following appointment were averaged and this score was entered on the data sheet.

The recording tape used to record the termination interview of subjects at the conclusion of treatment ended prior

to the interview of two subjects. Because this was not discovered until the tape was replayed, the termination interviews are incomplete, giving an N of 9 to both experimental groups. During the initial pretesting session, the investigator failed to obtain or lost one projective drawing from a subject in the experimental group and one from a subject in the control group. Hence, the N used in the chi-square analysis of the projective drawing was based on a total number of 28, rather than the planned 30.

### Dropped Subjects

Four subjects who began treatment were dropped from the data analysis. Two of the four completed the treatment schedule but increased or changed their medication in kind during the early weeks of treatment as required by their physicians. One subject, advised by her physician that she "could expect no change" by participating in the study, chose to terminate rather than invest her time. The fourth subject terminated following a missed appointment on the part of the investigator due to a scheduling error.

### Hypotheses

- 1A. There will be no significant difference in changes on blood pressure measures among Groups X, Y, and the control group, C.

The means of the blood pressure measures of the experimental and control groups are shown in Tables 1, 2, and 3, and include repeated measures over time.

Table 1

Means, Standard Deviations, and the Analysis of  
Variance Summary for the Change in Systolic  
Blood Pressure Among Groups X, Y, and C

Group	Pre Means	Post Means	Change
X	153.7	149.5	-4.200 (5.996)
Y	149.3	143.0	-6.300 (5.774)
C	150.7	152.1	1.400 (5.796)

---

Source	df	MS	F
Between groups	2	158.4332	4.619*
Within groups	<u>27</u>	34.3000	
Total	29		

\*p = .05

Note: The standard deviations are in parentheses.

Table 2

Results of Tukey Multiple Comparison Test  
of Significance of Mean Systolic Blood Pressure  
Change Between Groups X and Y, X and C, and Y and C

	X	Y	C
X	--	2.1	5.6
Y	2.1	--	7.7*
C	5.6	7.7*	--

\*p < .05.

Table 3

Means, Standard Deviations, and the Analysis of  
Variance Summary for the Change in Diastolic  
Blood Pressure Among Groups X, Y, and C

Group	Pre Means	Post Means	Change
X	104.2	102.3	-1.900 - (3.807)
Y	103.5	93.2	-9.500 - (7.590)
C	100.2	101.8	1.600 (2.633)
-----			
Source	df	MS	F
Between groups	2	328.0332	12.450*
Within groups	<u>27</u>	26.3481	
Total	29		

\*p = .05

Note: The standard deviations are in parentheses.

Table 4

Results of Tukey Multiple Comparison Test  
of Significance of Mean Diastolic Blood Pressure  
Change Between Groups X and Y, X and C, and Y and C

	X	Y	C
X	--	8.0*	3.1
Y	8.0*	--	11.1*
C	3.1	11.1*	--

\*p < .05.

The mean systolic and diastolic measures for Group X were obtained in the following manner: on each measurement occasion, the systolic and diastolic pressures were taken twice and recorded in order to provide a modal value. When a change in the blood pressures occurred between the first and second measurements, no modal score existed. A third measurement was then made and the median score, based on the three measurements, was recorded. The prescore is the arithmetic mean of the modal or median values obtained during the baseline measurement sessions. A median or modal value was obtained at each treatment session and averaged to provide a weekly mean score. The postscore is the average of the median or modal values obtained at the last two treatment sessions.

The mean systolic and diastolic measure for Group Y were obtained in the same manner, except that the mean score for each week was averaged from the median or modal value taken at the single treatment session. The postmean is the average of the means of the median or modal values taken prior to the final treatment session and at a posttreatment measurement session.

Whenever a subject missed a treatment session and did not complete it at a later date, the average between the median or modal value obtained immediately prior to and following the missed session was recorded as the value for that session. The mean premeasures for Group C were obtained in the same manner as for Groups X and Y. The control group's

postmean scores were obtained during the final measurement sessions scheduled for that purpose.

As shown in Table 1, the analysis of variance indicated a systolic change among Groups X, Y, and C which was statistically significant at the .05 level. The Tukey multiple comparison procedure which provides protection against experimentwise error was used to locate the difference between the means (Table 2). It was found that Group X does not differ significantly from Groups C and Y, but that Group Y is significantly different from C. Therefore, the treatment that Group Y received appears to produce a statistically significant difference in diastolic blood pressure, and an inspection of the means shows the change to be a decrease.

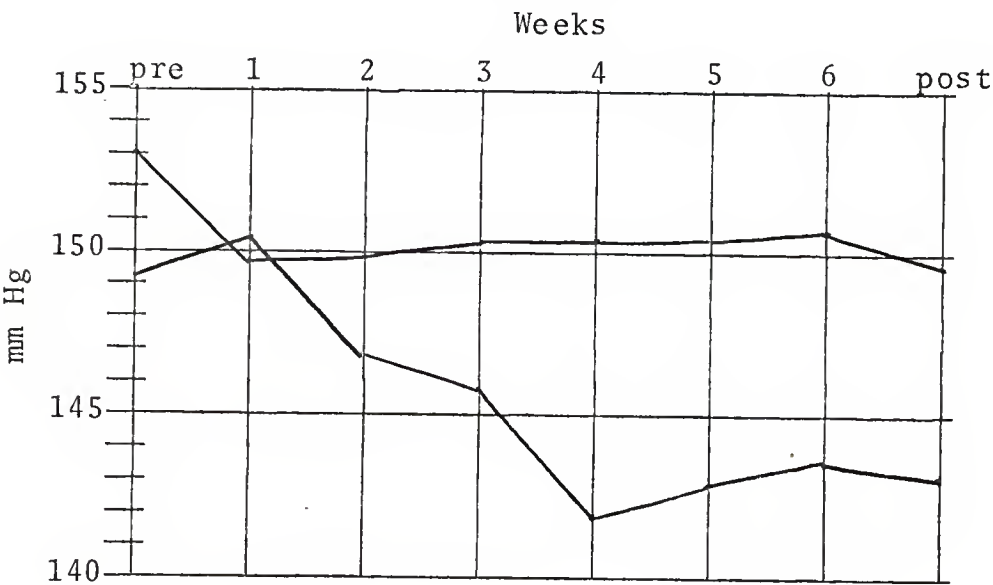
In Table 3, the analysis of variance indicates a diastolic change among Groups X, Y, and C which was statistically significant at the .05 level. The Tukey multiple comparison test showed that both groups X and Y were different from Group C, but not significantly different from each other (Table 4). As shown, the change is negative and indicates a decrease in mean diastolic blood pressure. Hypothesis 1A is rejected.

A trend analysis was run on the repeated measures of blood pressure recorded at weekly intervals for the experimental groups. The performance of the groups was found not to parallel over time. The comparisons of the profile analyses were not relevant because of the lack of parallelism (Table 5).

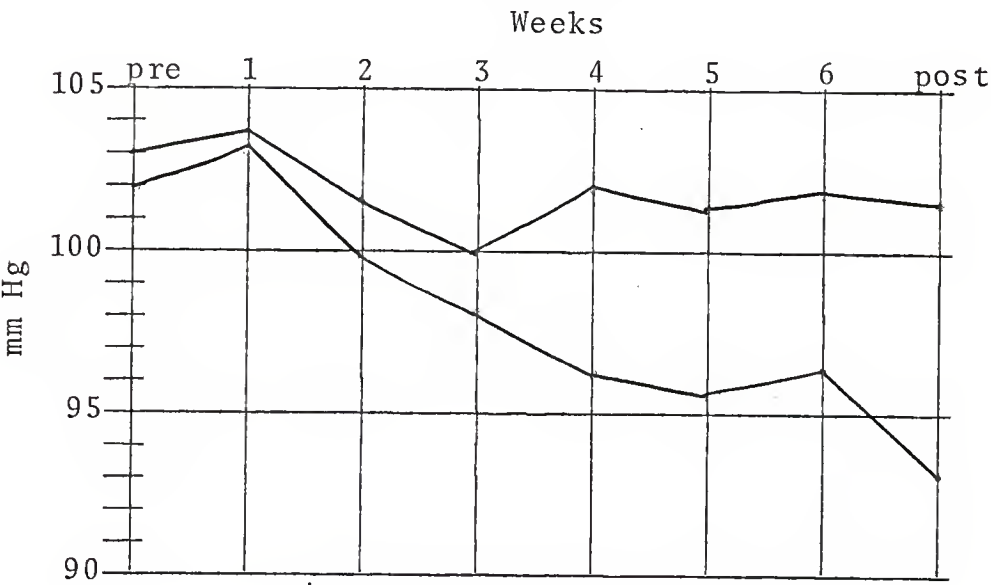


Table 5

Means of Groups X and Y on Systolic Blood Pressure Measures Over the Six-Week Treatment Period



Means of Groups X and Y on Diastolic Blood Pressure Measures Over the Six-Week Treatment Period



- 1B. There will be no clinically significant difference in changes on blood pressures among Groups X, Y, and the control group, C.

Three Florida licensed physicians with no involvement in this study nor its outcome were selected to render their judgments as to the clinical significance of the reductions obtained in blood pressure within the experimental groups. Dave Pawlinger, M.D.; Robert Ashley, M.D.; and W. C. Evans, M.D., concluded that the treatment received by Group X failed to produce sufficient reduction in blood pressure to be clinically worthwhile (Appendix D). The treatment received by Group Y did result in decreases in blood pressure that were large enough to have practical usefulness in the management of essential hypertension. Thus, the clinical worth of the treatment received by Group Y was confirmed, and Hypothesis 1B is rejected.

2. There will be no significant relationship between the scores of subjects in the treatment groups on the I-E Scale and amount of reduction in blood pressure.

The mean reduction in blood pressure was calculated by weighting the diastolic measure twice. The Pearson product-moment correlation of 0.06 did not achieve the magnitude to reach statistical significance at the  $<.05$  level. Hypothesis 2 has failed to be rejected.

3. There will be no significant difference among scores on the I-E Scale achieved by subjects in Groups X, Y, and C.

Analysis of variance of scores indicates that no differences among the groups were statistically significant at the

<.05 level of confidence; thus, the hypothesis failed to be rejected. The results are shown in Table 6.

Table 6

Means, Standard Deviations, and Analysis of Variance  
Summary Table for Scores on the I-E Scale  
Among Subjects in Group X, Group Y, and Group C  
as Achieved During the Posttesting Session

Group	Means	Standard Deviations	Standard Error
X	10.7000	4.4485	1.4067
Y	12.4000	7.2449	2.2910
C	14.800	4.1312	1.3064
-----			
Source	df	MS	F
Between groups	2	42.4336	.0257
Within groups	<u>27</u>	29.7815	
Total	29		

In addition to the main hypotheses investigated in this study, five questions of an exploratory nature were examined.

#### Exploratory Questions

1. Do scores on the Hy and D scales of the MMPI differ between the subjects in Groups X and Y as compared with Group C, at the conclusion of treatment?

Analysis of variance was used to determine if a statistically significant difference existed among the groups. The groups were not found to be significantly different from each other at the .05 level (Table 7).

on the Hy and D scales of the MMPI do not statistically differ among Groups X, Y, and C.

Table 7

Means, Standard Deviations, and Analysis of Variance  
Summary Table for Scores on the Hy and D Scales  
of the MMPI Among Groups X, Y, and C  
as Achieved During the Posttesting Session

Group	Hy Scale Means	D Scale Means		
X	22.000 (6.5490)	25.000 (4.1096)		
Y	21.400 (6.7773)	23.700 (6.9290)		
C	23.900 (6.0268)	26.500 (8.8349)		
-----				
Variable	Source	df	MS	F
Hy	Between groups	2	17.0371	0.639
	Within groups	<u>27</u>	38.7150	
	Total	29		
-----				
D	Between groups	2	19.6348	0.651
	Within groups	<u>27</u>		
	Total	29		

Note: The standard deviations are in parentheses.

- Will ratings of positiveness of body image as measured by the D-A-P test differ between Groups X and Y compared with Group C at the conclusion of treatment?

Dr. Betty Horne, a clinical psychologist with no involvement in the outcome of the study, rated the projective drawings of all of the subjects. The post figure drawing of each

subject was judged to be substantially different or not different from a figure drawing completed in the baseline measuring session. If "different," then a second judgement was made as to whether the second drawing was positive (+) or negative (-) when compared to the first. A chi-square analysis used to test for proportion showed that the rated difference between the drawings of the experimental and control groups was not statistically different at the .05 level as shown in Table 8.

Table 8

Chi-Square Analysis for Experimental and Control Groups on Projective Drawing Ratings

Rating	Control	Experimental	Total
No difference	6	6	12
Negative difference	2	7	9
Positive difference	2	6	8
-----			
Total	10	19	29

$$x^2 = 2.4926.$$

$$df = 2.$$

3. What aspects of the treatment affect the subject in a negative manner?

The taped termination interviews were monitored by Mary Ganikos, Specialist in Education. Ms. Ganikos is a counselor and has no involvement in the outcome of the study. She

selected excerpts, and summarized the negative aspects of the treatment as follows:

1. Two subjects complained that the treatment received by Group X was an imposition and "confining."
2. Six subjects disliked the tapes and felt the instructions given were not sufficiently clear.
3. One person disliked the required form.
4. Three subjects experienced scheduling problems.
5. The remaining subjects responded idiosyncratically, suggesting improvements ranging from using a direct, in-artery measure of blood pressure to obtaining a greater number of subjects "because the more you have, the more you help."

Four subjects spontaneously provided the following information related to their negative experiences associated with the treatment procedure. The other subjects were asked to describe the undesirable aspects so that the procedures could be improved in the future.

Subject 1. The four times a week may be too much . . . I remember that the first time I come in each week it seems more effective, but by the last time you don't want to sit down so much. Two or three times would be better, with a day in between. The tapes were very boring, and I felt resentful, especially when it was very late, and instead of going to sleep I would have to do my exercises.

Subject 2. The tapes don't help me because I'm not at all . . . is the word 'subjective?' Suggestable? I'm not at all influenced by words as so many people are. Words are not emotional. I don't get so close to them. I didn't use words very well in speech. I only read. I just have a built-in resistance towards anything anyone tells me. I figure ninety-nine percent of the time it isn't so. Nothing that is told me on the tapes has any influence on me. Perhaps I'm over-critical on this point. Teaching at the University I get so much B.S. Maybe that is it.

Subject 3. Improve the study? Directly monitor the blood pressure and not use the head-band approach.



Subject 4. I can't think of any way.

Subject 5. The four times a week was a little bit much for me, confining. On the days when I didn't feel particularly good it was a chore for me.

Subject 6. Nothing . . . much. I have a hearing problem that I'm ashamed of . . . sometimes when Paula . . . well, with different voices I just don't hear much. [Question: Did you hear the clicks?] Yes, I heard them . . . I been to the doctor and he says there isn't anything I can do about it.

Subject 7. The scheduling was mixed up. The last time I came in I waited for 15 minutes and this might have thrown the blood pressure machine off.

Subject 8. After the first two tapes I could go to sleep, but after the last one, between it and the recorder I got, well, I didn't get too much benefit out of it. Whenever it would cut off, I would think it was the recorder, then I found out the tapes had breaks in it . . . she said 'a few minutes' but it felt like fifteen minutes. I got other things to do.

Subject 9. You didn't give clear instructions about the tapes and I got my second one late.

Subject 10. You need to give clearer instructions about the tapes.

Subject 11. I resented filling out the forms . . . the categories didn't always fit how I felt. Sometimes I didn't feel exactly happy, and I think that it should allow for different shades.

Subject 12. You should get more people into the study. The more you have, the more people you help.

Subject 13. Get people coming in on time so you don't have to wait. I guess that's hard to do, to get people to come in when they're supposed to.

Subject 14. If you had some money, get some GSR equipment . . . I think, you know, you should measure both ways. People with high blood pressure tend to sweat a lot, you know, that would give you a little more calibration to the blood pressure. I am hot two or three times a week for no reason. There must be something.

Subject 15. The location should be more central.

Subject 16. Expectation is an important factor, and I really felt surprised that you were going to ask me some questions in addition to picking up the questionnaire. It would have been better if you would have said, 'Look, I want to ask you some questions, too,' instead of just coming in and, here we are, and you have your equipment, and it is totally unexpected . . . but otherwise it was fine.

Subject 17. Generally if you could put the tapes on some background music, that has a tendency to relax you also, like a real soft background.

Subject 18. At first I found it difficult to get into the tapes, but after a while I got to where I looked forward to doing them.

Subjects 19 and 20. Malfunction in tape recording.

4. Does self-regulation of blood pressure affect the way in which a person views his external environment with respect to his coping strategy or life style?

The excerpts selected by Ms. Ganikos are presented below.

She summarized the responses as follows:

1. Most of the subjects seem to use the techniques that they learned to increase the degree of relaxation during their daily lives, in the physiological sense.
2. Most of the subjects experienced a new awareness of the sensation of tension and were able to avert tension headaches, "spells" of high blood pressure, chronic body tension, and anxiety.
3. Most subjects experienced changes in their life styles, in that they became less rigid and perfectionistic about time, neatness, and the need to achieve, and could perform better at work, home, and school.
4. Two subjects reported no change attributable to participation in the study.

Information concerning the subjects' life styles or coping behavior was elicited by an open-ended question,

spontaneously volunteered, or, in one case, directly requested.

Subject 1. When nothing is happening, like in class, I now become aware that I am a little tense, I don't know why . . . there must be some reason for it. Like, when nothing is happening, then I pay attention to myself and I feel tense. Before the study I never had any manifestations of tension, except maybe the high blood pressure.

Subject 2. These results . . . mine has been consistently going down. There has been no decline in my outside stress. Before I knew what to do, but now I am more reinforced. I haven't changed the method I use to relax but now the idea is reinforced that it is doing some good. And I will hold that relaxation for a longer period than before. I can't hold that under normal conditions. And I go to sleep much faster now.

Subject 3. I think I have relaxed some . . . it has done some good.

Subject 4. I feel like it helped me, not as far as my blood pressure, but my emotional well-being, my headaches and things like that. When I used to be getting a headache I'd wait until it got bad and then I'd try to do something about it. Now I don't let a lot of little things upset me. I don't worry in advance about how things are going to come out. For example, six extra people spent the night at our house Friday night . . . I just sort of took it in stride. I think too that a part of it is being able to express myself to my husband. I don't worry about if he is going to object. . . I go ahead and sometimes explain the reason. [Question: How about the headaches you mentioned?] It did decrease the number of them. I learned to recognize when I was getting one. I just concentrated on it. I read some articles on biofeedback, and if it is worth the effort that other people are putting in on it, it certainly is worth my effort. Now I try to keep from overdoing. Even my tennis game is better . . . we played doubles last night, my husband and I, and we are winning . . . I guess it is because I don't overdo and am more relaxed playing.

I sense the feelings of relaxation. Before I would think I was relaxed, but now I seem to feel it. If I go into a situation that I think is going to cause me tension, I say 'no' I'm going to stay relaxed.

When I say 'My face is smooth,' I have sort of a drawing sensation up in here. I used to have sinus

trouble up there, but when I say 'my forehead is smooth,' it kinda drains out. I used to wake up about 4 o'clock in the morning but now I don't do that.

Subject 5. It was revealing in several ways . . . it made you aware of parts that were tense that I really wasn't aware of . . . I started paying attention.

Subject 6. Sometimes when tempers get up a little bit . . . I never was too bad . . . but I just let things so.

Subject 7. I can calm down better. With the tape I could relax . . . I used the Dean's office if it was during the day. There are a lot of tensions in the office, right at this minute. [Explanation of inter-personal conflicts omitted.] In my case this was helpful. It was a particularly bad time and normally I stay hyper. I can shoot my pressure up. Using the tapes I could lower it so I could get by.

Subject 8. No reported effect.

Subject 9. I used to be the type to want to get everything done . . . now I can go off and leave the dishes. This has a lot to do with my childhood. I felt pressured. Now I realize that I don't have to.

It gave me a new perspective of the values of things. I don't know why doing this did it, but it did! I can't explain how sitting in that chair, hearing those clicks. . . (laughs).

Subject 10. I use it constantly. One day I had a headache; I sat down and thought about the tapes. I did learn that my body tells me things . . . I didn't realize how tense I was 'til I relaxed. Before I resented the loss of time from things I should be doing. I felt guilty when I relaxed. Now I am making some changes; I am going back to school . . . I have been able to take things more casually.

Subject 11. I definitely know that I have a problem.

Subject 12. I've had terrific headaches the last six years . . . I've been on medication the whole time. I had constant headaches. Nothing would eradicate them. Constantly, day and night. After my first three sessions on the machine and listening to the tapes, I haven't had a headache since. You're some

kind of woman, I'll tell you that, lady! Prior to the time I started taking training with you and your staff out there, the least little thing my family would do, I'd fly off the handle. I don't do that any more. Right now I'm working 16 hours a day . . . I don't hurt any more. I just got a \$1,400 raise. They weren't going to give me the promotion at the Post Office because they didn't think I would take the pressure with the headaches and all, but now they decided to . . . I'm working 16 hours on the new job and I still feel fine. No headaches at all. And a few weeks ago I went by to Dr. McCollough and he checked my pressure and he cut my medicines in half.

Subject 13. I'm trying to pull some grades up that were bad.

Subject 14. I'm more aware of the importance of relaxing, not that I'm any more able to relax, but I'm more aware of it.

The only thing we can control is our thoughts.

You might as well relax because people are going to criticize you anyway.

Subject 15. Well, I tried to relax and slow down. Today I was late but I didn't do my normal rushing out here, like you said. You are getting me into bad habits! That is so ingrained in me. Between you and the nurse, you're getting me to slow down.

Subject 16. What I said was I had difficulty relaxing my face versus my arms, my extremities.

Subject 17. No, I don't believe that I have actually slowed down any, I just haven't had time to.

Subject 18. I seem to feel better, I don't know how to describe it. I feel loose and get along better all through the day. One thing, I know that I used to be a lot more nervous and tight in my shoulders but now, when I start to feel like that, I move around or do something else.

Subjects 19 and 20. Malfunction in tape recorder.



5. How does a subject describe the psychological process by which he effects muscle relaxation?

The descriptions of the process were selected by Ms.

Ganikos and are summarized as:

1. Most of the subjects seem to mentally repeat the key words learned from the tapes, shifting their awareness through different areas of their bodies until they reach a "numb" or "floating" state.
2. The remaining subjects strive to achieve a "blank" mind and "nothing" feeling.

The subjects were asked how they achieved a feeling of relaxation.

Subject 1. How? It is nothing special. It is like doing anything else, you don't think of what to do, you just do it.

Subject 2. It's relaxing the face and throat muscles. The rest of my body I don't have any connection with it really. I can disengage myself from it as far as relaxation is concerned. My trouble is in my mind . . . neither my worries nor my joys are from my limbs. Whatever I do, I do in my head.

Subject 3. Sometimes I'd let my mind just be blank, and sometimes I'd try to project my mind somewhere else. Sitting down in the tropics, down on the beach. I just try to lay there and let my mind go blank and see what it does to the clicks per second.

Subject 4. Mainly by relaxing the muscles in my face and my forehead, and also by changing positions. When I used to be riding along in the car on a trip my legs and shoulders would be tired, but by changing positions, by not holding myself up tense, I feel better. I get more comfortable when I am sitting down.

Subject 5. Trying to clear . . . just not think of anything or something pleasant, not a project or anything to do. No one thing . . . every day was different. It's still easier for me to relax the top part of me, not the legs, and it is still a problem that I haven't solved yet. The legs are still the hardest part. That was very interesting to me . . . why should the legs be the hardest part. That is still a mystery. It's an awareness-type thing. It



has made me aware of the effects that parts of the body has on the whole body. Generally whenever I am doing something and I feel something tightening up in me, the tapes go through my mind. The one that fits that particular need . . . I 'hear' it. First I realize this is tight or that is tight, the jaw, the hand, the legs, and then I relate that part back to the tapes.

Subject 6. Relaxation is a numb feeling. I do it by thinking of nothing.

Subject 7. The key words . . . I went by 'limp,' 'relaxed,' . . . words like that.

I would say like 'my arms are limp' . . . and go all over my body like that, probably in the same order because I am a creature of habit. I would try not to think of anything, because I have a bad habit of trying to do several things at once . . . read and watch TV, and such things as that.

Subject 8. That tick tick tick got to singing a song to you and then I drop off to sleep. I guess it was a very tell-taleing little instrument. I put everything away from my mind. Just say forget it all. But if I knew that I was going to be there for several hours I couldn't do it, my mind would start making plans. I felt that might be why I could relax here . . . it was just a short time. I think about things at work at night.

Subject 9. I hear the words. I sit and I hear the words.

Subject 10. Just repeating I was calm, comfortable and relaxed, especially my forehead. I get floating sensations. I hypnotize myself.

Subject 11. I memorized the tapes and did it from memory the last three weeks. You don't take as long . . . but you don't really relax.

Subject 12. I done exactly as the lady said on the tapes. Like she told you to get in a comfortable position . . . don't cross your arms and don't cross your legs. She give you the different positions and she explain to you the muscles. Then she went to the forehead which is where I kept the burning headache before. That's where you put the sense-i-gram, that's what I call it [referred to the electrode]. At first it sounded like a machine gun, but after two or three sessions with that machine, I got it down to where it

sounded like a water faucet dripping. Now, really, I don't know how to thank ya. You worked wonderful things for me, I'll tell you that.

Let me explain to you how it felt to me. The tapes start off with the right arm. By the time it gets to the left arm, the right arm doesn't feel like you have it any more . . . it is not asleep, but in a perfectly relaxed position. Then I'd concentrate on bringing that machine down. The way it felt to me as I'd relax one portion of my body, then another, it felt like floating on Cloud Nine. You don't have any sensation to you, like asleep, but I don't know what sleep feels like because I'm asleep.

Subject 13. I just sit back and shift my awareness all over and feel it relaxing. I became aware of what I was feeling and just let it go. I'd just feel floaty, not so pushing down. Sometimes I'd just blank my mind out, and feel what is there.

Subject 14. By being conscious that if I tell myself to relax, I do.

Subject 15. I relax different days in different ways. I know where the electrodes are. I try to do the neck and face. That's really trying to beat the machine, I know. The time the girl was here with the red hair, I didn't know her, and felt very impersonal. The clicks were the lowest then because I wasn't trying to please anyone. Maybe it was the movie the night before or maybe. . . .

Subject 16. On my face I feel with my fingers to feel the tension and I look with my eyes to see how far I get. On the rest of my body I have no special way. I think I could feel the difference. I could feel the tensing and relaxing more readily than on my face. Relaxing didn't happen all at once. I felt I got better at it. At first the whole side of me would tense. The more I did it the more I could narrow it down.

Subject 17. I relax by sitting down in a chair with a can of beer. And I use the phrases from the tapes.

Subject 18. In two ways: first, I shift my awareness all over my body, and where I find a spot of tension, I relax it by letting go. Then, when I am quite relaxed, I use the key words, like 'limp' to

achieve a greater relaxed state. It's quite beneficial. I have profited a great deal by being in this program.

Subjects 19 and 20. Malfunction in tape recording.

## CHAPTER IV

### DISCUSSION

One of the purposes of the study was to examine the efficiency of two treatment schedules in decreasing high blood pressure. The results appear to favor the treatment assigned to Group Y. The importance of the outcome of the study seems to lie in the fact that those who participated in a treatment which required only one biofeedback session weekly reduced their blood pressures more than those who were required to schedule four sessions per week in the hospital setting.

While the amount of reduction sustained by the experimental groups did not approach that achieved by the Moeller study [1973], it should be noted that (1) the pre mean blood pressures of the subjects in this study were less than those in Moeller's experiment, and (2) Moeller's treatment period extended for 16 weeks, in contrast to the 6-week duration of the treatment in this study.

Clinical impressions. The most apparent difference between Groups X and Y seemed to be related to the degree of personal responsibility the subjects assumed for their "commitment" or involvement in the study. The subjects in Group X established a deeper interpersonal relationship with the

experimenter and her assistants, and it is possible that the quality of this relationship interfered with their performance. In addition, approximately 30% of the subjects in Groups X and Y indicated that they were less apt to complete the practice session outside of the laboratory on days that they attended the biofeedback session, because of the time required to participate.

Group X seemed to relate to the experimenter and her assistants as to an authority figure. In general, two response patterns seemed to emerge. First, several subjects seemed eager to gain the approval of the experimenter by reporting their "good" behavior, such as diligence at carrying out the practice sessions outside of the laboratory, attempts to avoid tension related to conflict situations, the diminution of headaches and insomnia. The subjects verbalized a variety of excuses for not completing the practice sessions and for being late for appointments. Their complaints ranged from a dislike of the wording used on the tapes to the noise produced by the hospital's air conditioning system. They seemed to have a need to place "blame" outside themselves for their feelings of failure at not achieving the desired state of relaxation.

In both cases, the interpersonal relationship afforded the subjects an opportunity to develop an expectation of reinforcement external to themselves. This opportunity was less available for members of Group Y since the number of biofeedback sessions was 75% less.

It is also possible that the Group X subjects experienced greater desire to learn to control themselves than those in Group Y. When the subjects were assigned, four individuals placed in Group X withdrew before the treatment began due to the number of required visits to the hospital setting. None of the Group Y subjects withdrew for this reason. Therefore, it is possible that the subjects in Group X differed from those in Group Y at the beginning of the study. Relaxation is dependent, in part, upon the subject's ability to let go of tension and not control himself, in the sense of using active volition. To the experimenter, it seemed that the psychological need for increased self-control required to complete the treatment schedule of Group X was associated with a behavior pattern in which the subjects used external manipulation of themselves. They appeared to try to make themselves relax in the same active manner by which they volitionally increase tension. The results achieved by the subjects on the I-E Scale suggests that this might be the case, although the means were not different enough to reach statistical significance.

No procedure was established to insure consistent practice for all subjects outside of the laboratory setting. It is the opinion of this researcher that the subjects in Group X failed to be as consistent in home practice as those in Group Y. This judgement was based on the unrecorded remarks made by the subjects rather than on an analysis of the data on the practice sheets. In general, subjects felt that the time required to travel to and from the hospital setting and



to participate in the biofeedback session interfered with their ability to complete an additional session of relaxation at home on the same day. It seems probable that Group X actually received less progressive relaxation and autogenic training than was proposed since they participated in four biofeedback sessions in the laboratory each week. The practice sheets on which the subjects recorded responses related to the practice sessions were collected but no verbal feedback was given to the subjects.

The logistics of carrying out the study presented certain difficulties in keeping uniform personal interactions among groups. An attempt was made to structure interaction with the subjects, but the subjects in Group X frequently sought the attention of the experimenter and her assistants. It was thought that a lack of response would be viewed as rejection and might lead to a termination in participation. Therefore, deeper relationships emerged than were planned.

Conclusion. It seems apparent, for a complexity of reasons, that the treatment assigned to those subjects in Group X was not as clinically efficient in reducing high blood pressure as the treatment assigned to Group Y.

#### Exploratory Questions

According to the statistical analysis, the scores of subjects do not differ among groups on the Hy and D scales of the MMPI to the extent where the differences approached

statistical significance. An inspection of the means (Table 6) shows that Group Y, who reduced their pressures the most, scored lower on the hypochondriasis and depression scales than Group X, and that Group X scored lower than the control group. Were the number of subjects larger for each group, the direction of the differences would suggest that the treatment may tend to reduce the characteristics measured by these scales. While the overall mean score on the Hy scale fell within normal limits on the MMPI, the mean for D scale, which related to feelings of depression, were elevated two standard deviations above the mean for the general population.

Individuals who score high on this scale are characterized as silent, retiring, tending to sidestep troublesome situations, respectful of others, overcontrolling of their impulses, inhibited, worrying, frank, sensitive, indecisive, moody, and somewhat withdrawn. An elevated score indicated low frustration tolerance, poor morale, feeling blue, discouraged, dejected, and useless. This scale is described as the best single index of immediate satisfaction and comfort in living [Van De Riet and Wolking, 1968]. These adjectives seemed to be consistent with the experimenter's observation of the subjects involved in the study.

If the subjects in the experimental group have developed a more positive body image as a result of participation in the study, the ratings of the drawings failed to demonstrate the change. The chi-square analysis showed no significant difference between the ratings of the experimental and control subjects at the .05 level.

Three aspects were probed by the experimenter during the course of the termination interview: (1) the negative aspects of the procedures, (2) the effect of increased self-regulation of blood pressure on one's coping strategy or life style, and (3) the process by which the subjects achieve muscle relaxation. The purpose of these questions was to provide information on which to modify procedures.

Three subjects expressed dissatisfaction regarding delays in the appointments. This complaint could be reduced in future undertakings if "free" time would be scheduled between the treatment appointments of subjects, so that if one subject is late, the others will not also have to wait. The subjects sometimes found the instructions on the tapes confusing. Several initially remarked about soreness from tensing specific muscle groups. It is the opinion of the experimenter that difficulty in following instructions was partly related to individual's personality traits rather than to the instructions on the tapes. Some subjects experienced a dislike for the key words used, such as "quite quiet," and "limp."

The relaxation techniques employed in the reduction of blood pressure seemed to sensitize the subjects to feelings of psychological and physiological tension and provided a strong suggestion as to the undesirability of tension. The heightened awareness led to a variety of changes considered by most to be desirable. One subject in Group X, who reported that he was less perfectionistic and more easy-going, implied that the experimenter was to "blame" for the change in his

behavior. This incident provides an insight into conflict experienced by some. The idea of placing one's self and one's own organismic needs before the cultural values of "hard" work, the importance of "suffering," and the need to appear as "perfect" as possible to others proved to be a difficult shift.

The psychological process through which relaxation was effected seemed to involve the use of passive suggestion of key phrases. Most subjects experienced the inability to actively "make" themselves relax, but learned instead to first become aware of the feeling of tension and, next, to discontinue the tensing process. Several subjects who did not comment on this difference continued to try to relax by making their minds "a blank" or by "doing nothing" and experienced some success. Others used manipulation of their daily living patterns to reduce "stress," by not "working so hard," adopting a less demanding attitude, or paying more attention to the task at hand rather than to a future goal.

Implications for counseling. The goals of traditional psychotherapy, humanism, behaviorism, and the new "fourth force" called transpersonal psychology have in common a belief that increased awareness of one's own processes, be they psychological or physiological, will lead toward greater personal freedom and growth. One function of the therapist is to assist the individual to better know himself through feedback of information. The content of the information depends upon the therapist's orientation; the cognitive therapists impart

"insights," the Rogerians "relect feelings," the behaviorists produce change of maladaptive, classically conditioned responses; and those within the emerging "fourth force" encourage the individual to "experience himself" by becoming more aware of his organism's true needs, in contrast to those imposed by the culture.

Inherent in the use of relaxation training is the assumption that physiological tension in the skeletal musculature impairs full awareness of one's experience. Individuals often attempt to avoid the experience of feelings that are unpleasant, such as fear, anger, or loss, by increasing muscle tension. Unaware of the underlying avoidances, these individuals often report symptoms such as chronic anxiety, headaches, and pain. For many, the incident that precipitated the muscle tension has been resolved, but the tension has remained as an undesirable habit or unobserved behavior.

Relaxation training assists the individual to get in touch with himself in that relaxation reduces the perceptual static and facilitates fuller experience of one's self. As the subjects reported, they became more aware of the process by which they produce tension, and now experience a choice between continuing to tense themselves or becoming relaxed. In addition, the experimenter thinks that the subjects perceived that the nature of the task conveyed to the subjects a belief that inappropriate tension is a negative quality; the subjects were indirectly rewarded for removal of tension and for remaining relaxed. For many, staying "relaxed" became a

higher priority goal than being on time, getting a task accomplished within an established time period, or repressing or controlling anger and frustration. Subjects, through awareness of the mind-body interactions, reported that they used the phrases learned in the recorded exercises to achieve the desired relaxation state.

It appears that relaxation training can be useful both as an adjunct to a verbal psychotherapy and as a method in itself. The experimenter noted that subjects became more fluent verbally and emotionally expressive as relaxation progressed. Often subjects remarked about the emergence of repressed memories or "forgotten" events. Simply re-experiencing the earlier feelings seems to be therapeutic for some. Others reported that they did not "feel" different but observed, among other things, that they were less demanding of themselves, took less medication, stopped smoking, had fewer headaches, improved interpersonal relationships, achieved greater sexual satisfaction, were more tolerant of stress at work, and reduced insomnia, teeth grinding, nail biting, the consumption of alcohol and the intake of fattening foods. Two of the twenty individuals in the experimental groups felt that participation had little or no value.

#### Suggestions for Future Research

The results of this study demonstrate the usefulness of the application of a short-term relaxation program to a



stress-related condition such as essential hypertension. The need exists for further investigation of the interaction between the psychological and physiological components in organismic functioning.

In particular, it is suggested that future research efforts be directed toward the development of improved techniques to enable an individual to shift from a state of active volition to passive volition.

## LIST OF REFERENCES

- AHP. Biofeedback in action--seminars for professionals. San Francisco, Calif., 1973.
- Alexander, F. Emotional factors in essential hypertension. Psychosomatic Medicine, 1939, 1, 139.
- Angyal, A. Foundations for a science of personality. New York: Commonwealth Fund, 1941.
- APA. Committee on Ethical Standards for Psychology. Ethical standards for psychology. American Psychologist, 1963, 18, 56-60.
- APGA. Ethical standards: American Personnel and Guidance Association. Personnel and Guidance Journal, 1961, 40, 206-209.
- Assagioli, R. Psychosynthesis: A manual of principles and techniques. New York: Hobbs, Dorman, 1965.
- Barber, T. X., Di Cara, L. V., Kamiya, J., Miller, N. E., Stoyva, J. (Eds.). Biofeedback and self-control: An Aldine reader on the regulation of bodily processes and consciousness. Chicago: Aldine-Atherton, 1971.
- Basmajian, J. V. Control and training of individual motor units. Science, 1963, 141, 440-41.
- Benson, H., Shapiro, D., Tursky, B., and Schwartz, G. E. Decreased systolic blood pressure through operant conditioning techniques in patients with essential hypertension. Science, 1971, 173, 740-42.
- Bibring, E. The mechanism of depression. In P. Greenacre, ed., Affective disorders. New York: International Univ. Press, 1953.
- Blanchard, E. B., and Young, L. D. Self-control of cardiac functioning: A promise as yet unfulfilled. Psychological Bulletin, 1973, 79(3), 145-55.
- Brener, J., and Kleinman, R. A. Learned control of decreases in systolic blood pressure. Nature, 1970, 225, 1063-64.

- Brown, C. C., and Katz, Ruth A. Operant salivary conditioning in man. Psychophysiology, 1967, 4, 156-60.
- Budzynski, T. H., and Stoyva, J. M. An instrument for producing deep muscle relaxation by means of analog information feedback. Journal of Applied Behavior Analysis, 1969, 2, 231.
- Budzynski, T. H., Stoyva, J. M., and Adler, C. S. Feedback-induced relaxation: Application to tension headaches. Behavior Therapy and Experimental Psychiatry, 1970, 1, 205-211.
- Campbell, J. P., and Dunnette, M. D. Effectiveness of t-group experiences in managerial training and development. Psychological Bulletin, 1968, 70, 73-104.
- Carkhuff, R. R., and Bereson, B. G. Beyond counseling and therapy. New York: Holt, Rinehart and Winston, 1967.
- Carlson, R. Where is the person in personality research? Psychological Bulletin, 1971, 75, 203-219.
- Chronback, L. J., and Ferby, Al. How should we measure change or should we? Psychological Bulletin, 1970, 74, 68-80.
- Clark, K. E. (Chairman). Privacy in behavioral research. Executive Office of the President, Washington, D.C., 1967.
- Crider, Andrew B., Schwartz, Gary E., and Shnidman, Susan. On the criteria for instrumental autonomic conditioning: A reply to Katkin and Murray. Psychological Bulletin, 1969, 71, 455-61.
- Datey, K. K., Deshmukh, S. N., Dalva, C. P., and Vinekar, S. L. A yogic exercise in the management of hypertension. Angiology, 1969, 20, 329-33.
- Davidson, Richard, and Krippner, Stanley. Biofeedback research: Data and implications. Paper presented at the Seventeenth International Congress of Applied Psychology, July 25-30, 1971, Liege, Belgium.
- Di Cara, L. V., and Miller, N. E. Instrumental learning of systolic blood pressure responses by curarized rats: Disassociation of cardiac and vascular changes. Psychosomatic Medicine, 1968, 30, 489-94.
- Engel, B. T., and Melmon, L. Operant conditioning of heart rate in patients with cardiac arrhythmias. Conditional Reflex, 1968, 3, 130.
- Frezza, Daniel A., and Holland, James G. Operant conditioning of the human salivary response. Psychophysiology, 1971, 8(5), 581-87.

- Gellhorn, E. Autonomic-somatic integrations. Minneapolis: Univ. of Minn. Press, 1967.
- Goodenough, F. L. Measurement of intelligence by drawing. Tarrytown-on-Hudson, N.Y.: World, 1926.
- Green, E. E., Green, A. M., and Walters, E. D. Voluntary control of internal states: Psychological and physiological. Journal of Transpersonal Psychology, 1970, 2(1).
- Green, E. E., Walters, E. D., Green, A. M., and Murphy, Gardner. Feedback techniques for deep relaxation. Psychophysiology, 1969, 6(3), 371-77.
- Gressell, G. C. Personality factors in arterial hypertension. Journal of the American Medical Association, 1949, 140, 61-72.
- Gynther, Malcolm D., and Rogers, David A. A review. In O. K. Buros, ed., The seventh mental measurements yearbook. Highland Park, N.J.: Gryphon Press, 1944.
- Harris, R. E., Sokolow, M., Carpenter, L. G., Friedman, M., and Hunt, S. P. Response to psychologic stress in persons who are potentially hypertensive. Circulation, 1953, 7, 874-79.
- Harrison, V. F., and Mortensen, O. A. Identification and voluntary control of single motor unit activity in the tibialis anterior muscle. Anatomical Record, 1962, 144, 109-16.
- Hart, Joseph T., and Tomlinson, T. M. Beyond psychotherapy: A programmatic essay on the applied psychology of the future. New directions in client-centered therapy. New York: Houghton Mifflin, 1970.
- Hathaway, S. R., and McKinley, J. C. The Minnesota multiphasic personality inventory: Manual. New York: Psychological Corp., 1951.
- Hill, L. B. Psychoanalytic observation on essential hypertension. Psychoanalytic Review, 1935, 22, 60.
- Hnatow, Michael, and Lang, Peter J. Learned stabilization of cardiac rate. Psychophysiology, 1965, 1.
- Honoraton, C., Davidson, R. J., and Bindler, P. Feedback-augmented EEG alpha shifts in subjective state and ESP card-guessing performance. Journal of the American Society for Psychical Research, 1971, 65, 308-23.

- Jacobson, Edmund. Progressive relaxation. Chicago: Univ. of Chicago Press, 1938.
- \_\_\_\_\_. Variation of blood pressure with skeletal muscle tension and relaxation. Annals of Internal Medicine, 1939, 12, 1194.
- \_\_\_\_\_. You must relax. New York: McGraw-Hill, 1957.
- Johnson, H. J., and Swartz, G. E. Suppression of GSR activity through operant reinforcement. Journal of Experimental Psychology, 1967, 75, 307-12.
- Kahn, R. L., and Campbell, Charles F. The dynamics of interviewing. New York: John Wiley and Sons, 1966.
- Karlins, Marvin, and Andrews, Lewis M. Biofeedback: Turning on the power of your mind. Philadelphia: J. B. Lippincott Co., 1972.
- Kamiya, J. Operant control of the EEG alpha rhythm and some of its reported effects on consciousness. In Charles Tart, Altered states of consciousness. New York: John Wiley and Sons, 1969, 489-501.
- Kamiya, J., Barber, T. X., Di Cara, Leo V., Miller, N. E., Shapiro, D., and Stoyva, Johann (Eds.). Biofeedback and self-control: An Aldine reader on the regulation of bodily processes and consciousness. Chicago: Aldine Atherton, 1971.
- Katkin, E. S., and Murray, E. N. Instrumental conditioning of autonomically mediated behavior: Theoretical and methodological issues. Psychological Bulletin, 1968, 70, 52-68.
- Klumbies, P., and Eberhardt, G. Results of autogenic training in the treatment of hypertension. In J. H. Schultz and Luthe, Autogenic therapy, vol. 1. New York: Grune and Stratton, 1969.
- Lacey, J. Somatic response patterning and stress: Some revisions of activation theory. In M. H. Appley and R. Turnbull (Eds.), Psychological stress. New York: Appleton-Century Crofts, 1967.
- Lang, Peter J. The application of psychophysiological methods to the study of psychotherapy and behavior modification. In Allen Bergin and S. L. Garfield, eds., Handbook of psychological therapy and behavior change: An empirical analysis. New York: Grune and Stratton, 1968.
- \_\_\_\_\_. Autonomic control or learning to play the internal organs. Psychology Today, 1970, 4 (October), 10.



- Lapides, Jack, Sweet, Robert B., and Lewis, Louis W. Role of striated muscle in urination. Journal of Urology, 1957, 77, 49.
- Laws, D. R., and Rubin, H. B. Instructional control of an autonomic sexual response. Journal of Applied Behavior Analysis, 1969, 2, 93-99.
- Lazarus, A. A. Behavior therapy and beyond. New York: McGraw-Hill, 1967.
- Lesh, T. V. Zen meditation and the development of empathy in counselors. Journal of Humanistic Psychology, 1970, 10(1), 39-74.
- Lisina, M. I. The role of orientation in the transformation of involuntary reactions into voluntary ones. In L. G. Voronin, A. N. Leontiev, A. R. Luria, E. N. Sokolov, and O. S. Vinogradova (Eds.), Orienting reflex and exploratory behavior. Washington: American Institute of Biological Sciences, 1965.
- Love, Elizabeth, and Love, W. A. Relaxation exercises. Personal tape recordings, 1973.
- Love, W. A., and Moeller, T. A. Personal communication, 1973.
- Love, W. A., Montgomery, Doil, and Calhoun, B. A program for muscular relaxation: Manual. An unpublished manuscript, Nova Univ., 1972.
- Lowen, Alexander. The betrayal of the body. New York: Collier Book, 1967.
- Lowenfeld, Viktor. Creative and mental growth. New York: Macmillan, 1947.
- Luthe, W. Autogenic training: Method, research, and application in medicine. American Journal of Psychotherapy, 1963, 17, 174-95.
- . Zur psychotherapeutischen verlaufskontrolle durch projektive tests bei autogenem training. In Aktuelle Psychotherapie, E. Speer (Ed.). J. F. Lehmanns Verlag, Munich, 1958, 159-68.
- Machover, Karen. Personality projection in the drawing of the human figure: A method of personality investigation. In Harold H. Anderson and Gladys L. Anderson (Eds.), An introduction to projective techniques. New York: Prentice Hall, 1951, 341-69.



- Maslow, A. H. Towards a psychology of being. Princeton: D. Van Nostrand, 1962.
- Merrill, J. P. Hypertensive vascular disease. In J. V. Harrison, R. D. Adams, I. J. Bennett, W. H. Resnick, G. W. Thorn, and M. M. Wintrobe (Eds.), Principles of internal medicine. New York: McGraw-Hill, 1966.
- Merton, R. Mass persuasion. New York: Harpers, 1946.
- Miller, N. E. Integration of neurophysiological and behavioral research. Annals of the New York Academy of Sciences, 1961, 92, 830-39.
- Moeller, T. A., and Love, W. A. A method to reduce arterial hypertension through muscular relaxation. An unpublished manuscript, Nova Univ., 1972.
- Moeller, T. A. Ph.D. dissertation. Nova University, 1973.
- Mulholland, Thomas B. Biofeedback: Its time to try hardware in the classroom. Psychology Today, 1973, 7(7).
- Murphy, G. Psychology in the year 2000. American Psychologist, 1969, 24, 523-30.
- O'Conner, Jr., Edward F. Extending classical test theory to the measurement of change. Review of Educational Research, Winter 1972, 42(1), 95.
- Paul, G. L. Physiological effects of relaxation training and hypnotic suggestion. Journal of Abnormal Psychology, 1969, 74, 425-37.
- Perls, F. S. Gestalt therapy verbatim. Lafayette, Calif.: Real People Press, 1969.
- Phares, E. J. Internal-external control as a determinant of amount of social influence exerted. Journal of Personality and Social Psychology, 1965, 2, 642-47.
- Pickering, George. High blood pressure. New York: Grune and Stratton, 1968.
- Pope, Alan. Integrator. Gainesville, Fla. 1973.
- Psychological Corp. The Minnesota Multiphasic Personality Inventory, New York, 1951.

- Razran, G. The observable unconscious and the inferable conscious in current soviet psychophysiology: Interoceptive conditioning, semantic conditioning, and the orienting reflex. Psychological Review, 1961, 68, 81-147.
- Rogers, Carl R. Client-centered therapy. Boston: Houghton-Mifflin, 1951.
- Rotter, Jullian. Generalized expectancies for internal versus external control of reinforcement. Psychological monographs: General and applied, 1966, 80(1).
- \_\_\_\_\_. External control and internal control. Psychology Today, 1971, 5(1), 37-42, 58-59.
- Schultz, J. H., and Luthe, W. Autogenic therapy, vol. 1. New York: Grune and Stratton, 1969.
- Shapiro, D., Tursky, B., Gershman, E., and Stern, M. Effects of biofeedback and reinforcement on the control of human systolic blood pressure. Science, 1969, 163, 588-89.
- Shapiro, D., Tursky, B., and Swartz, G. E. Control of blood pressure in man by operant conditioning. Circulation Research, 1970, 26 (Suppl. 1), 27, I-27 to I-32(a).
- Shapiro, D., Barber, T. X., Di Cara, L. V., Kamiya, J., Miller, N. E., and Stoyva, J. (Eds.). Biofeedback and self-control, 1972: An Aldine annual on the regulation of bodily processes and consciousness. Chicago: Aldine-Atherton, 1973.
- Shapiro, D., and Swartz, G. E. Biofeedback in essential hypertension: Current findings and theoretical concerns. Seminars in psychiatry, in press.
- Shapiro, D., Barber, T. X., Di Cara, L. V., Kamiya, J., and Miller, N. E. (Eds.). Biofeedback and self-control: An Aldine reader on the regulation of bodily processes and consciousness. Chicago: Aldine-Atherton, 1973.
- Shapiro, D., and Crider, A. Operant electrodermal conditioning under multiple schedules of reinforcement. Psychophysiology, 1967, 4, 168-75.
- Shapiro, D., Schwartz, G. E., and Tursky, B. Control of diastolic blood pressure in man by feedback and reinforcement. Psychophysiology, 1972, 9, 296-304.
- Shneidman, Edwin S. Projective techniques. In B. B. Wolman, ed., Handbook of clinical psychology. New York: McGraw-Hill, 1965, 498-510.

- Shultz, D. P. The human subject in psychological research. Psychological Bulletin, 1969, 72, 214-228.
- Snyder, Charles, and Noble, Merrill. Operant conditioning of vasoconstriction. Journal of Experimental Psychology, 1968, 77, 263-68.
- Stoyva, J., Barber, T. X., Di Cara, L. V., Kamiya, J., Miller, N. E., and Shapiro, D. (Eds.). Biofeedback and self-control: An Aldine reader on the regulation of bodily processes and consciousness. Chicago: Aldine-Atherton, 1972.
- Swartz, G. E. Biofeedback as therapy: Some theoretical and practical issues. American Psychologist, 1973, 28(8), 666-81.
- Van De Riet, Vernon, and Wolking, William D. Interpretive hypotheses for the MMPI. Unpublished paper, 1968.
- Velben, T. The theory of the leisure class. New York: Macmillan, 1899 (Modern Library edition, 1934).
- Wallace, R. K. Physiological effects of transcendental meditation. Science, 1969, 167, 1751-54.
- Wallace, R. K., Benson, H., and Wilson, A. F. A wakeful hypometabolic state. American Journal of Physiology, 1971, 221, 795-99.
- Weiner, N. Current status and future prospects for research in psychosomatic medicine. Journal of Psychiatric Research, 1971, 8, 479-98.
- Wenger, M. A., and Bagchi, B. K. Studies of autonomic functions in practitioners of yoga in India. Behavioral Science, 1961, 6, 312-23.
- White, R. W. Motivation reconsidered: The concept of competence. Psychological Review, 1959, 66, 297-333.

APPENDIX A  
FORMS

## Personal Data

1. Name \_\_\_\_\_ 2. Age \_\_\_\_\_ 3. Sex \_\_\_\_\_  
           (last)                 (first)
4. Address \_\_\_\_\_  
           (street)                 (town)                 (zip)
5. Phone \_\_\_\_\_ 6. How do we contact you? \_\_\_\_\_
7. Referred by: \_\_\_\_\_
8. Physician \_\_\_\_\_  
           (name)                                 (address)
9. Marital Status: circle one      Married, divorced, single,  
    separated, widowed
10. Occupation \_\_\_\_\_
11. How tall are you? \_\_\_\_\_ In the past year have you  
     gained \_\_\_\_\_ or lost \_\_\_\_\_ more than ten pounds without trying  
     to \_\_\_\_\_, or dieting \_\_\_\_\_? Describe situation \_\_\_\_\_
12. Have you been told that you have heart disease: yes \_\_\_\_ no \_\_\_\_  
    vascular condition: yes \_\_\_\_ no \_\_\_\_  
     IF NO, SKIP TO #16
13. Has a doctor told you that you had:  
         an abnormal electro-cardiogram (EKG) \_\_\_\_\_  
         an abnormal chest X-ray \_\_\_\_\_  
         angina pectoris \_\_\_\_\_  
         none of these \_\_\_\_\_
14. Has a doctor told you that you had:  
         a blood clot in an artery \_\_\_\_\_  
         a blood clot in a vein \_\_\_\_\_  
         an enlarged heart \_\_\_\_\_  
         none of these \_\_\_\_\_
15. Has a doctor told you that you had:  
         a heart attack or coronary \_\_\_\_\_ scarlet fever \_\_\_\_\_  
         a heart murmur \_\_\_\_\_ heart failure \_\_\_\_\_  
         low blood pressure \_\_\_\_\_ rheumatic fever \_\_\_\_\_  
         high blood pressure \_\_\_\_\_ none of these \_\_\_\_\_
16. Do you worry about your heart a lot? yes \_\_\_\_ no \_\_\_\_

IF MALE, SKIP TO #19

17. Are you pre-menopausal \_\_\_\_\_  
menopausal \_\_\_\_\_  
post-menopausal \_\_\_\_\_

18. Do you take birth control pills? no\_\_\_\_ yes\_\_\_\_  
brand\_\_\_\_\_

19. Do you have bad headaches? yes\_\_\_\_\_ no\_\_\_\_\_

IF NO, SKIP TO #28

20. Are they getting more frequent?    yes               no

21. How often do you get these headaches? every day \_\_\_\_\_  
several times a week \_\_\_\_\_  
once a week \_\_\_\_\_  
once a month or less \_\_\_\_\_

22. These headaches usually occur: in the morning \_\_\_\_\_  
in the evening \_\_\_\_\_  
during the day \_\_\_\_\_  
varies \_\_\_\_\_

23. These headaches usually last:
- |  |                    |                   |
|--|--------------------|-------------------|
|  | less than one hour | <u>          </u> |
|  | several hours      | <u>          </u> |
|  | several days       | <u>          </u> |

24. Does tension or nervousness trigger your headaches:  
yes no

25. Can you usually tell when you are going to get a headache?    yes            no

26. Do other people in your family have severe headaches?  
yes no

27. What medication do you take for your headache? \_\_\_\_\_  
Helps? \_\_\_\_\_

28. Do you have any allergies? yes \_\_\_\_\_  
(please describe)  
no \_\_\_\_\_

29. Do you often have: \_\_\_\_\_ cramping and gas with your bowel movements  
 \_\_\_\_\_ sweating palms  
 \_\_\_\_\_ trouble getting your breath  
 \_\_\_\_\_ sleep problems  
 \_\_\_\_\_ nervous twitches  
 \_\_\_\_\_ rapid heart beat  
 \_\_\_\_\_ indigestion  
 \_\_\_\_\_ gas  
 \_\_\_\_\_ cold feet or hands when you are under stress



30. How would you rate the tension in your life?

- ☐ less than most anyone  
☐ less than most  
☐ about the same as most people  
☐ more than most  
☐ more than most anyone

31. Have you had or do you have any of the following conditions? (please check)

<u>Condition</u>	<u>Previously</u>	<u>Currently</u>	<u>Current medication</u>
anemia			
apoplexy or stroke			
arthritis			
alcoholism			
asthma or hay fever			
bleeding tendency			
cancer			
cataracts			
cirrhosis			
congenital heart disease			
diabetes			
epilepsy			
eczema			
emphysema			
glaucoma			
gout			
heart disease			
high cholesterol			
high blood pressure			
kidney disease			
mental disorder			
leukemia			
kidney stones			
lung trouble			
nervous breakdown			
migraine headaches			
pernicious anemia			
rheumatic heart disease			
stomach or duodenal ulcer			
thyroid disease or goiter			
other			

What medications do you carry in your purse or have at home?

32. What kinds of physical exercise do you routinely engage in? \_\_\_\_\_

33. What kinds of religious spiritual, or meditative activities do you engage in? Describe \_\_\_\_\_

34. How do you relax? \_\_\_\_\_

## STANDARD CONSENT FORM

Subject: \_\_\_\_\_ Date: \_\_\_\_\_

I authorize the performance upon \_\_\_\_\_ the following treatment: the subject's forehead muscle tension will be monitored through the use of electromyograph equipment, and the information made available to the subject via auditory feedback. The subject will be encouraged to lower his degree of muscle tension. In addition, he will receive a series of relaxation exercises recorded on cassette tapes, to be played and practiced at home. Repeated measures of his blood pressure will be made by a competent examiner using a cuff sphygmomanometer and Littman stethoscope.

The nature and purpose of this treatment, possible alternative methods of treatment, the risks involved, and the possibilities of complications have been explained to me verbally and in writing by \_\_\_\_\_.

I fully understand that the procedure or treatment to be performed is experimental and not routine medical treatment. I also understand that I may not benefit from the treatment and that the consequences are not completely predictable. Furthermore, it is agreed that the information gained from these investigations may be used for educational purposes which may include publication. I understand that I may withdraw my consent at any time.

SIGNED \_\_\_\_\_

WITNESS \_\_\_\_\_

I, the undersigned, have defined and fully explained this treatment procedure to the above individual.

SIGNED \_\_\_\_\_

The proposed research has been approved by the Health Center Committee for the Protection of Human Subjects. If you have any further inquiries, they may be addressed to the Investigator or to the Committee for the Protection of Human Subjects, c/o Dean of the College of Medicine for the Health Center.

Attachment A

## DESCRIPTIVE CONSENT FORM

Title: LEARNED SELF-REGULATION OF ARTERIAL HYPERTENSION  
UTILIZING BIOFEEDBACK AND RELAXATION TRAINING.

The subject will be taught techniques of deep muscle relaxation through the use of biofeedback and relaxation exercises. It is expected that the elevated blood pressures associated with essential hypertension will be reduced as a function of deep relaxation. If this is demonstrated to occur, the harmful effects of sustained elevated blood pressure will diminish.

Repeated measures of blood pressure will be made, and, should the reading indicate an increase over the baseline measurements, a physician will be consulted before the subject will be allowed to continue in the treatment.

I have read and understand the above described treatment procedure in which I am to participate and have received a copy of this description.

SIGNED: \_\_\_\_\_

WITNESS: \_\_\_\_\_

INVESTIGATOR: \_\_\_\_\_

Subject \_\_\_\_\_

BLOOD PRESSURE DATA SHEET

S   D        S   D        S   D        S   D

- I. Baseline Measures:
- 1) a, \_\_\_ b, \_\_\_ c, \_\_\_
- 2) a, \_\_\_ b, \_\_\_ c, \_\_\_
- 3) a, \_\_\_ b, \_\_\_ c, \_\_\_

Systolic (S) \_\_\_\_\_ Diastolic (D) \_\_\_\_\_

II. Treatment Measures:

Treatment  
Week        Session

A	1	a, ___ b, ___ c, ___	___
	2	a, ___ b, ___ c, ___	___
	3	a, ___ b, ___ c, ___	___
	4	a, ___ b, ___ c, ___	___
B	1	a, ___ b, ___ c, ___	___
	2	a, ___ b, ___ c, ___	___
	3	a, ___ b, ___ c, ___	___
	4	a, ___ b, ___ c, ___	___
C	1	a, ___ b, ___ c, ___	___
	2	a, ___ b, ___ c, ___	___
	3	a, ___ b, ___ c, ___	___
	4	a, ___ b, ___ c, ___	___
D	1	a, ___ b, ___ c, ___	___
	2	a, ___ b, ___ c, ___	___
	3	a, ___ b, ___ c, ___	___
	4	a, ___ b, ___ c, ___	___

## II. Treatment Measures, con't.

Treatment Week	Session	S	D	S	D	S	D	S	D
E	1	a, _ _	b, _ _	c, _ _					
	2	a, _ _	b, _ _	c, _ _					
	3	a, _ _	b, _ _	c, _ _					
	4	a, _ _	b, _ _	c, _ _					
F	1	a, _ _	b, _ _	c, _ _					
	2	a, _ _	b, _ _	c, _ _					
	3	a, _ _	b, _ _	c, _ _					
	4	a, _ _	b, _ _	c, _ _					
G	1	a, _ _	b, _ _	c, _ _					
	2	a, _ _	b, _ _	c, _ _					
	3	a, _ _	b, _ _	c, _ _					
	4	a, _ _	b, _ _	c, _ _					
H	1	a, _ _	b, _ _	c, _ _					
	2	a, _ _	b, _ _	c, _ _					
	3	a, _ _	b, _ _	c, _ _					
	4	a, _ _	b, _ _	c, _ _					

## III. Post Treatment Measures:

1) a, \_ \_ b, \_ \_ c, \_ \_ \_ \_  
 2) a, \_ \_ b, \_ \_ c, \_ \_ \_ \_  
 3) a, \_ \_ b, \_ \_ c, \_ \_ \_ \_

Systolic \_ \_ Diastolic \_ \_

CHANGE SCORES: Systolic \_ \_ Diastolic \_ \_

Subject \_\_\_\_\_

Group \_\_\_\_\_

## Practice Record Chart - Week

Day I

A.M. \_\_\_\_\_ Did not complete \_\_\_\_\_  
 Fully attentive \_\_\_\_\_ Mostly attentive \_\_\_\_\_ Little attention \_\_\_\_\_  
 Very tense \_\_\_\_\_ Moderate tension \_\_\_\_\_ Little tension \_\_\_\_\_  
 Mood: happy \_\_\_\_\_ Appropriate \_\_\_\_\_ Depressed \_\_\_\_\_

Describe any feelings or unexpected bodily sensations that occurred during the practice session \_\_\_\_\_

P.M. \_\_\_\_\_ Did not complete \_\_\_\_\_  
 Fully attentive \_\_\_\_\_ Mostly attentive \_\_\_\_\_ Little attention \_\_\_\_\_  
 Very tense \_\_\_\_\_ Moderate tension \_\_\_\_\_ Little tension \_\_\_\_\_  
 Mood: happy \_\_\_\_\_ Appropriate \_\_\_\_\_ Depressed \_\_\_\_\_

Describe any feelings or unexpected bodily sensations that occurred during the practice session \_\_\_\_\_

Day II

A.M. \_\_\_\_\_ Did not complete \_\_\_\_\_  
 Fully attentive \_\_\_\_\_ Mostly attentive \_\_\_\_\_ Little attention \_\_\_\_\_  
 Very tense \_\_\_\_\_ Moderate tension \_\_\_\_\_ Little tension \_\_\_\_\_  
 Mood: happy \_\_\_\_\_ Appropriate \_\_\_\_\_ Depressed \_\_\_\_\_

Describe any feelings or unexpected bodily sensations that occurred during the practice session \_\_\_\_\_

P.M. \_\_\_\_\_ Did not complete \_\_\_\_\_  
 Fully attentive \_\_\_\_\_ Mostly attentive \_\_\_\_\_ Little attention \_\_\_\_\_  
 Very tense \_\_\_\_\_ Moderate tension \_\_\_\_\_ Little tension \_\_\_\_\_  
 Mood: happy \_\_\_\_\_ Appropriate \_\_\_\_\_ Depressed \_\_\_\_\_

Describe any feelings of unexpected bodily sensations that occurred during the practice session \_\_\_\_\_

Day III

A.M. \_\_\_\_\_ Did not complete \_\_\_\_\_  
 Fully attentive \_\_\_\_\_ Mostly attentive \_\_\_\_\_ Little attention \_\_\_\_\_  
 Very tense \_\_\_\_\_ Moderate tension \_\_\_\_\_ Little tension \_\_\_\_\_  
 Mood: happy \_\_\_\_\_ Appropriate \_\_\_\_\_ Depressed \_\_\_\_\_

Describe any feelings of unexpected bodily sensations that occurred during the practice session \_\_\_\_\_



Day III (con't.)

P.M. \_\_\_\_\_ Did not complete \_\_\_\_\_  
 Fully attentive \_\_\_\_\_ Mostly attentive \_\_\_\_\_ Little attention \_\_\_\_\_  
 Very tense \_\_\_\_\_ Moderate tension \_\_\_\_\_ Little tension \_\_\_\_\_  
 Mood: happy \_\_\_\_\_ Appropriate \_\_\_\_\_ Depressed \_\_\_\_\_

Describe any feelings or unexpected bodily sensations that occurred during the practice session \_\_\_\_\_

Day IV

A.M. \_\_\_\_\_ Did not complete \_\_\_\_\_  
 Fully attentive \_\_\_\_\_ Mostly attentive \_\_\_\_\_ Little attention \_\_\_\_\_  
 Very tense \_\_\_\_\_ Moderate tension \_\_\_\_\_ Little tension \_\_\_\_\_  
 Mood: happy \_\_\_\_\_ Appropriate \_\_\_\_\_ Depressed \_\_\_\_\_

Describe any feelings or unexpected bodily sensations that occurred during the practice session \_\_\_\_\_

P.M. \_\_\_\_\_ Did not complete \_\_\_\_\_  
 Fully attentive \_\_\_\_\_ Mostly attentive \_\_\_\_\_ Little attention \_\_\_\_\_  
 Very tense \_\_\_\_\_ Moderate tension \_\_\_\_\_ Little tension \_\_\_\_\_  
 Mood: happy \_\_\_\_\_ Appropriate \_\_\_\_\_ Depressed \_\_\_\_\_

Describe any feelings or unexpected bodily sensations that occurred during the practice session \_\_\_\_\_

Day V

A.M. \_\_\_\_\_ Did not complete \_\_\_\_\_  
 Fully attentive \_\_\_\_\_ Mostly attentive \_\_\_\_\_ Little attention \_\_\_\_\_  
 Very tense \_\_\_\_\_ Moderate tension \_\_\_\_\_ Little tension \_\_\_\_\_  
 Mood: happy \_\_\_\_\_ Appropriate \_\_\_\_\_ Depressed \_\_\_\_\_

Describe any feelings or unexpected bodily sensations that occurred during the practice session \_\_\_\_\_

P.M. \_\_\_\_\_ Did not complete \_\_\_\_\_  
 Fully attentive \_\_\_\_\_ Mostly attentive \_\_\_\_\_ Little attention \_\_\_\_\_  
 Very tense \_\_\_\_\_ Moderate tension \_\_\_\_\_ Little tension \_\_\_\_\_  
 Mood: happy \_\_\_\_\_ Appropriate \_\_\_\_\_ Depressed \_\_\_\_\_

Describe any feelings or unexpected bodily sensations that occurred during the practice session \_\_\_\_\_

Day VI

A.M. \_\_\_\_\_ Did not complete \_\_\_\_\_  
 Fully attentive \_\_\_\_\_ Mostly attentive \_\_\_\_\_ Little attention \_\_\_\_\_  
 Very tense \_\_\_\_\_ Moderate tension \_\_\_\_\_ Little tension \_\_\_\_\_  
 Mood: happy \_\_\_\_\_ Appropriate \_\_\_\_\_ Depressed \_\_\_\_\_

Describe any feelings or unexpected bodily sensations that occurred during the practice session \_\_\_\_\_

Day VI (con't.)

P.M. \_\_\_\_\_ Did not complete \_\_\_\_\_  
 Fully attentive \_\_\_\_\_ Mostly attentive \_\_\_\_\_ Little attention \_\_\_\_\_  
 Very tense \_\_\_\_\_ Moderate tension \_\_\_\_\_ Little tension \_\_\_\_\_  
 Mood: happy \_\_\_\_\_ Appropriate \_\_\_\_\_ Depressed \_\_\_\_\_

Describe any feelings or unexpected bodily sensations that occurred during the practice session \_\_\_\_\_

Day VII

A.M. \_\_\_\_\_ Did not complete \_\_\_\_\_  
 Fully attentive \_\_\_\_\_ Mostly attentive \_\_\_\_\_ Little attention \_\_\_\_\_  
 Very tense \_\_\_\_\_ Moderate tension \_\_\_\_\_ Little tension \_\_\_\_\_  
 Mood: happy \_\_\_\_\_ Appropriate \_\_\_\_\_ Depressed \_\_\_\_\_

Describe any feelings or unexpected bodily sensations that occurred during the practice session \_\_\_\_\_

P.M. \_\_\_\_\_ Did not complete \_\_\_\_\_  
 Fully attentive \_\_\_\_\_ Mostly attentive \_\_\_\_\_ Little attention \_\_\_\_\_  
 Very tense \_\_\_\_\_ Moderate tension \_\_\_\_\_ Little tension \_\_\_\_\_  
 Mood: happy \_\_\_\_\_ Appropriate \_\_\_\_\_ Depressed \_\_\_\_\_

Describe any feelings or unexpected bodily sensations that occurred during the practice session \_\_\_\_\_

What feelings are you aware of just prior to the practice sessions? \_\_\_\_\_

What feelings often occur at the conclusion of the practice session? \_\_\_\_\_

What events have occurred in your life (during this week) to which you have reacted with increased tension? \_\_\_\_\_

How have you behaved during this week that has produced feelings of deep relaxation? Describe your behavior \_\_\_\_\_

Use reverse side for any additional comments.

Thank you for your cooperation.

APPENDIX B  
STANDARD INSTRUCTIONS

## Instructions for Volunteers

The purpose of this study is to look at the actual effects of a new treatment approach on the reduction of blood pressure. We will need volunteers with high blood pressure who also meet certain other criteria that are determined by the experimental design of the study. Everyone who participates will be required to have the consent of his physician, and will continue to take his prescribed medication on a regular basis during the duration of the experimental treatment. Our study will attempt to lower blood pressure by teaching you how to relax your muscles.

After you have completed the forms and questionnaires, we will select certain individuals and assign them to a specific treatment schedule. It is important that you fully understand what you will be required to do before you will know if it is possible for you to participate. Are there any questions so far?

After we go over the data that you are completing now, we will notify you if we will use you in the study, and ask you to return for two more preliminary sessions before your treatment will be initiated. Next time you will fill out some additional questionnaires, and have your blood pressure measured. In the last preliminary session, the principles of biofeedback will be explained, and you will have a chance to try out the equipment. There will be some relaxation exercises for you to do at your home or office, twice a day.

This will require that you have access to a tape player that will handle tapes like these (show cassette tape) and that you have a quiet place in which to lie down and do them. You will be required to attend a training session using the bio-feedback equipment either once or four times a week, depending on the group that you get assigned to. The biofeedback laboratory is located at North Florida Regional Hospital where you will find ample parking space.

In order to keep the study free from the unknown effects that each of you might have upon the other, in terms of enthusiasm or motivational level, we ask that you do not discuss your treatment schedule or any other aspects of the study with each other. When it is concluded, we will have a big party, and we can talk about our experiences then.

If you are not selected to participate, it does not mean that this treatment approach could not be of help to you in reducing your blood pressure, but rather that we have enough individuals in your age range with the same blood pressure level. All of you will be informed of the results of this study when it is completed and the data are analyzed.

When you have completed the forms, please go to the bathroom, empty your bladder, and return to your chair so that my co-worker, Ms. \_\_\_\_\_, can record your blood pressure with this cuff. We will always take it 3 times in succession to get a reliable reading.

Any questions? Thank you. You will hear from us next week.

## Instructions to Subjects

All of you here today will be subjects in the study, but will not have the same treatment schedule. In order to know more about each of you, we ask that you complete the questionnaire and drawing that are being passed out to you, in folders. Place your name, last name first, on the tab of the folder. All of your records will be coded in order to preserve your privacy. No one will know what your answers are, except me. In return for my promise of confidentiality, I hope that you will feel free to answer as honestly as possible. Any questions?

When you have completed the questionnaires and drawing, please use the bathroom located in the next room. After you empty your bladder, return to your chair.

I am looking forward to our next session so that I can explain the use of the biofeedback equipment to each of you, and give you a chance to operate it yourself. Thank you for coming.



### Conclusion Questions

Directions for Administration: The following questions are to be asked to each subject during the period of time following the biofeedback session as the electrodes are being removed. No response will be made by the examiner unless asked a direct question by the subject.

1. How did the session seem to go today?
2. How do you feel now?
3. Do you have any questions?

Unusual responses are to be noted in each subject's folder.

## APPENDIX C

### TESTS

# THE INTERNAL-EXTERNAL SCALE

Directions for administration: Read aloud. "This is a questionnaire to find out the way in which certain important events in our society affect different people. Each item consists of a pair of alternatives lettered "a" or "b." Please select the one statement of each pair (and only one) which you more strongly believe to be the case as far as you are concerned. Be sure to select the one you actually believe to be more true, not the one you think you should choose, or the one you would like to be true. This is a measure of your personal belief: as you read it, you will see that there are no right or wrong answers.

Record your answers on the answer sheet provided by checking statement "a" or "b." PRINT YOUR NAME ON YOUR ANSWER SHEET.

Please answer these items carefully and do not spend too much time on any one item. Be sure to make a choice for each pair of statements. In some instances you may discover that you believe both statements or neither one to be true. Select the one you believe to be the most true for you. Also, try to respond to each pair of statements independently when making your choices: do not be influenced by previous choices."

Scoring: The score is the total number of external choices. These are listed below.

- |           |           |            |            |            |
|-----------|-----------|------------|------------|------------|
| 1. filler | 7. a      | 13. b      | 19. filler | 25. a      |
| 2. a      | 8. filler | 14. filler | 20. a      | 26. b      |
| 3. b      | 9. a      | 15. b      | 21. a      | 27. filler |
| 4. b      | 10. b     | 16. a      | 22. b      | 28. b      |
| 5. b      | 11. b     | 17. a      | 23. a      | 29. a      |
| 6. a      | 12. b     | 18. a      | 24. filler |            |

THIS SHEET IS NOT TO BE GIVEN TO THE SUBJECT

Name \_\_\_\_\_

- |                       |                       |
|-----------------------|-----------------------|
| 1. a. _____ b. _____  | 16. a. _____ b. _____ |
| 2. a. _____ b. _____  | 17. a. _____ b. _____ |
| 3. a. _____ b. _____  | 18. a. _____ b. _____ |
| 4. a. _____ b. _____  | 19. a. _____ b. _____ |
| 5. a. _____ b. _____  | 20. a. _____ b. _____ |
| 6. a. _____ b. _____  | 21. a. _____ b. _____ |
| 7. a. _____ b. _____  | 22. a. _____ b. _____ |
| 8. a. _____ b. _____  | 23. a. _____ b. _____ |
| 9. a. _____ b. _____  | 24. a. _____ b. _____ |
| 10. a. _____ b. _____ | 25. a. _____ b. _____ |
| 11. a. _____ b. _____ | 26. a. _____ b. _____ |
| 12. a. _____ b. _____ | 27. a. _____ b. _____ |
| 13. a. _____ b. _____ | 28. a. _____ b. _____ |
| 14. a. _____ b. _____ | 29. a. _____ b. _____ |
| 15. a. _____ b. _____ | 30. a. _____ b. _____ |

1.
  - a. Children get into trouble because their parents punish them too much.
  - b. The trouble with most children nowadays is that their parents are too easy with them.
2.
  - a. Many of the unhappy things in people's lives are partly due to bad luck.
  - b. People's misfortunes result from the mistakes they make.
3.
  - a. One of the major reasons why we have wars is because people don't take enough interest in politics.
  - b. There will always be wars, no matter how hard people try to prevent them.
4.
  - a. In the long run, people get the respect they deserve in this world.
  - b. Unfortunately, an individual's worth often passes unrecognized no matter how hard he tries.
5.
  - a. The idea that teachers are unfair to students is nonsense.
  - b. Most students don't realize the extent to which their grades are influenced by accidental happenings.
6.
  - a. Without the right breaks one cannot be an effective leader.
  - b. Capable people who fail to become leaders have not taken advantage of their opportunities.
7.
  - a. No matter how hard you try some people just don't like you.
  - b. People who can't get others to like them don't understand how to get along with others.
8.
  - a. Heredity plays the major role in determining one's personality.
  - b. It is one's experiences in life which determine what they're like.
9.
  - a. I have often found that what is going to happen will happen.
  - b. Trusting to fate has never turned out as well for me as making a decision to take a definite course of action.
10.
  - a. In the case of the well-prepared student there is rarely if ever such a thing as an unfair test.
  - b. Many times exam questions tend to be so unrelated to course work that studying is really useless.
11.
  - a. Becoming a success is a matter of hard work, luck has little or nothing to do with it.
  - b. Getting a good job depends mainly on being in the right place at the right time.

12.
  - a. The average citizen can have an influence in government decisions.
  - b. This world is run by the few people in power, and there is not much the little guy can do about it.
13.
  - a. When I make plans, I am almost certain that I can make them work.
  - b. It is not always wise to plan too far ahead because many things turn out to be a matter of good or bad fortune anyhow.
14.
  - a. There are certain people who are just no good.
  - b. There is some good in everybody.
15.
  - a. In my case getting what I want has little or nothing to do with luck.
  - b. Many times we might just as well decide what to do by flipping a coin.
16.
  - a. Who gets to be the boss often depends on who was lucky enough to be in the right place first.
  - b. Getting people to do the right things depends upon ability, luck has nothing to do with it.
17.
  - a. As far as world affairs are concerned, most of us are the victims of forces we can neither understand, nor control.
  - b. By taking an active part in politics and social affairs the people can control world events.
18.
  - a. Most people don't realize the extent to which their lives are controlled by accidental happenings.
  - b. There really is no such thing as "luck."
19.
  - a. One should always be willing to admit mistakes.
  - b. It is usually best to cover up one's mistakes.
20.
  - a. It is hard to know whether or not a person really likes you.
  - b. How many friends you have depends on how nice a person you are.
21.
  - a. In the long run the bad things that happen to us are balanced by the good ones.
  - b. Most misfortunes are the result of lack of ability, ignorance, laziness, or all three.
22.
  - a. With enough effort we can wipe out political corruption.
  - b. It is difficult for people to have control over the things politicians do in office.



- 23.
  - a. Sometimes I can't understand how teachers arrive at the grades they give.
  - b. There is a direct connection between how hard I study and the grades I get.
- 24.
  - a. A good leader expects people to decide for themselves what they should do.
  - b. A good leader makes it clear to everybody what their jobs are.
- 25.
  - a. Many times I feel that I have little influence over the things that happen to me.
  - b. It is impossible for me to believe that chance or luck plays an important role in my life.
- 26.
  - a. People are lonely because they don't try to be friendly.
  - b. There's not much use in trying too hard to please people, if they like you, they like you.
- 27.
  - a. There is too much emphasis on athletics in high school.
  - b. Team sports are an excellent way to build character.
- 28.
  - a. What happens to me is my own doing.
  - b. Sometimes I feel that I don't have enough control over the direction my life is taking.
- 29.
  - a. Most of the time I can't understand why politicians behave the way they do.
  - b. In the long run the people are responsible for bad government on a national as well as on a local level.

## MINNESOTA MULTIPHASIC PERSONALITY INVENTORY

(Hy and D)

Directions for administration: Read aloud. "This inventory consists of numbered statements. Read each statement and decide whether it is true as applied to you or false as applied to you. You are to mark your answers on the answer sheet provided. If a statement is TRUE or MOSTLY TRUE, as applied to you, put a check after the "T." If a statement is FALSE or MOSTLY FALSE as applied to you, put a check in the space after the "F." If a statement does not apply to you or if it is something that you don't know about, make no mark on the answer sheet.

Remember to give your own opinion of yourself. Do not leave any blank spaces if you can avoid it.

In marking your answers on the answer sheet, be sure that the number of the statement agrees with the number on the answer sheet. Erase completely any answer you wish to change. Go ahead."

THIS SHEET IS NOT TO BE GIVEN TO THE SUBJECT

1. I have a good appetite.
2. I wake up fresh and rested most mornings.
3. I am easily awakened by noise.
4. I like to read newspaper articles on crime.
5. My hands and feet are usually warm enough.
6. My daily life is full of things that keep me interested.
7. I am about as able to work as I ever was.
8. There seems to be a lump in my throat much of the time.
9. I enjoy detective or mystery stories.
10. I am very seldom troubled by constipation.
11. I am troubled by attacks of nausea and vomiting.
12. I feel that it is certainly best to keep my mouth shut when I'm in trouble.
13. At times I feel like swearing.
14. I find it hard to keep my mind on a task or job.
15. I seldom worry about my health.
16. At times I feel like smashing things.
17. I have had periods of day, weeks, or months when I couldn't take care of things because I couldn't "get along, or get going."
18. My sleep is fitful and disturbed.
19. Much of the time my head seems to hurt all over.
20. My judgement is better than it ever was.
21. Once a week or oftener I feel suddenly hot all over, without apparent cause.
22. I am in just as good physical health as most of my friends.
23. I prefer to pass by school friends, or people I know but have not seen for a long time, unless they speak to me first.
24. I am almost never bothered by pains over the heart or in my chest.
25. I am a good mixer.
26. Everything is turning out just like the prophets of the Bible said it would.
27. I sometimes keep on at a thing until others lose their patience with me.
28. I wish I could be as happy as others seem to be.
29. I think a great many people exaggerate their misfortunes in order to gain the sympathy and help of others.
30. Most of the time I feel blue.
31. Sometimes I tease animals.
32. I am certainly lacking in self-confidence.
33. I usually feel that life is worth while.
34. It takes a lot of argument to convince most people of the truth.
35. I think most people would lie to get ahead.
36. I go to church almost every week.
37. I believe in the second coming of Christ.
38. I have little or no trouble with my muscles twitching or jumping.
39. I don't seem to care what happens to me.
40. I am happy most of the time.

41. Some people are so bossy that I feel like doing the opposite of what they request, even though I know they are right.
42. Often I feel as if there were a tight band around my head.
43. I seem to be about as capable and smart as most others around me.
44. Most people will use somewhat unfair means to gain profit or an advantage rather than to lose it.
45. The sight of blood neither frightens me nor makes me sick.
46. Often I can't understand why I have been so cross and grouchy.
47. I have never vomited blood or coughed up blood.
48. I do not worry about catching diseases.
49. I commonly wonder what hidden reason another person may have for doing something nice for me.
50. I believe that my home life is as pleasant as that of most people I know.
51. Criticism or scolding hurts me terribly.
52. My conduct is largely controlled by the customs of those around me.
53. I certainly feel useless at times.
54. At times I feel like picking a fist fight with someone.
55. I have often lost out on things because I couldn't make up my mind soon enough.
56. Most nights I go to sleep without thoughts or ideas bothering me.
57. During the past few years I have been well most of the time.
58. I have never had a fit or convulsion.
59. I am neither gaining nor losing weight.
60. I cry easily.
61. I cannot understand what I read as well as I used to.
62. I have never felt better in my life than I do now.
63. I resent having anyone take me in so cleverly that I have had to admit that it was one on me.
64. I do not tire quickly.
65. What others think of me does not bother me.
66. I frequently have to fight against showing that I am bashful.
67. I have never had a fainting spell.
68. I seldom or never have dizzy spells.
69. My memory seems to be all right.
70. I am worried about sex matters.
71. I find it hard to make talk when I meet new people.
72. I am afraid of losing my mind.
73. I frequently notice my hand shakes when I try to do something.
74. I can read a long while without tiring my eyes.
75. I feel weak all over much of the time.

76. I have very few headaches.
77. Sometimes, when embarrassed, I break out in a sweat, which annoys me greatly.
78. I have had no difficulty in keeping my balance in walking.
79. I do not have spells of hay fever or asthma.
80. I wish I were not so shy.
81. I enjoy many different kinds of play and recreation.
82. I like to flirt.
83. In walking I am very careful to step over sidewalk cracks.
84. I hardly ever notice my heart pounding and I am seldom short of breath.
85. I have at times stood in the way of people who were trying to do something, not because it amounted to much but because of the principle of the thing.
86. I get mad easily and then get over it soon.
87. I brood a great deal.
88. I dream frequently about things that are best kept to myself.
89. I believe I am no more nervous than most others.
90. I have few or no pains.
91. Sometimes without any reason or even when things are going wrong I feel excitedly happy, "on top of the world."
92. I can be friendly with people who do things which I consider wrong.
93. I have difficulty in starting to do things.
94. I sweat very easily even on cool days.
95. It is safer to trust nobody.
96. When in a group of people, I have difficulty thinking about the right things to talk about.
97. When I leave home I do not worry about whether the door is locked and the windows closed.
98. I do not blame a person for taking advantage of someone who lays himself open to it.
99. At times I am all full of energy.
100. My eyesight is as good as it has been for years.
101. I drink an unusually large amount of water every day.
102. Once in a while I laugh at a dirty joke.
103. I am troubled by attacks of nausea and vomiting.
104. I am always disgusted with the law when a criminal is freed through the arguments of a smart lawyer.
105. I work under a great deal of tension.
106. I am likely not to speak to people until they speak to me.
107. I have periods in which I feel unusually cheerful without any special reason.

APPENDIX D  
LETTERS



W. C. EVANS, JR., M.D.  
225 S.W. 7th Terrace  
Gainesville, Florida 32601

---

Telephone: 372-8461

7/5/74

Dear Ms. Orlando:

I have reviewed the statistics on means, medians, and modals of your B.P. experiment with biofeedback and find them very interesting. I will attempt to give you my opinion as regards the clinical practicality of such.

I do not know the differences between applied methods in Group X and Group Y. Clinically (notwithstanding mathematical significance) I would say that the difference between Group X and control group is of no value or practical usefulness. However, the difference between Group Y and control seems clinically applicable and could be of value in management of hypertensive patients.

If I can help you further, do let me know.

Best wishes,

W. C. Evans, Jr., M.D.

TOWER MEDICAL GROUP  
209 N.W. 75th Street (Tower Road)  
Gainesville, Florida 32601

Daniel B. Cox, M.D., Cardiology  
Jared C. Kniffen, M.D., F.A.C.P., Gastroenterology  
Arthur A. Mauceri, M.D., Infectious Diseases and  
Immunology  
David F. Pawliger, M.D., Hematology

July 29, 1974

Jacqueline Orlando  
407 N.W. 39th Road  
Gainesville, Florida 32601

Dear Jackie:

I have reviewed the data that you submitted on the effect of relaxation training using autogenic therapy and EMG feedback on essential hypertension. You asked me to comment from a clinician's viewpoint on the significance of the blood pressure changes. This is somewhat difficult to do without knowing the circumstances under which the readings were obtained. The questions that I would ask are 1) How was the blood pressure measured; 2) Is each blood pressure recording the result of a single reading or the average of several determinations; 3) Was the study done in a "blind" fashion?

In Group X only three patients had what I would consider to be a meaningful reduction in systolic pressure and none had a meaningful reduction in diastolic pressure. In Group Y two patients had a meaningful reduction in systolic and five patients a meaningful reduction in diastolic pressure. There was no meaningful change in pressure recorded in Group C. If one compares the median (not the mean) pressures in each group before and after relaxation training, the only group that had an apparent change was Group Y with a 7 mm decrease in systolic and a 9 mm decrease in diastolic pressure.

It has been shown that reduction in diastolic pressure will decrease the incidence of certain complications of hypertension. However, the reduction in diastolic pressure must be sustained in order to achieve this benefit. Fifty per cent of patients in one of your groups had a clinically significant reduction in diastolic pressure, but in order to judge the clinical usefulness of this response, I would have to know that the diastolic pressures remained at a lower level for a significant period of time.

Sincerely yours,

David F. Pawliger, M.D.

EVALUATION FOR JACKIE ORLANDO  
MEAN, MEDIAN AND MOTILE MEASURES  
OF BLOOD PRESSURE IN GROUPS  
X, Y, AND Z

7/27/74

Groups X and Y reported being treated with biofeedback and Group Z a control group.

1. Analysis interpretation of Group X of the 10 patients in Group X, all have mild to moderate systolic and diastolic hypertension in the pretreatment measurements. In the posttreatment measurements, the systolic component had returned to normal and two of the 10 of the patients in the diastolic component remained elevated, and all 10 in the posttreatment. The drop in diastolic pressure was significant enough to return the systolic pressure readings to normal in two of the 10 patients. It did not appear to significantly lower the diastolic pressure in Group Y. All patients of this group have both systolic and diastolic hypertensive components. Two in this group had diastolics above 110 which falls into a moderately severe hypertensive range. In Group Y in the posttreatment group readings the systolic measurements remained at or above the defined limits for systolic hypertension. The diastolic components appeared to be significantly lowered in seven of the 10 patients of the patients of the control group, again, all had both systolic and diastolic components to their hypertension. At the end of the control period, all remained hypertensive with essentially no change in their blood pressure readings.
2. In a short study of biofeedback, effects on the control of hypertension, it appears that, in at least a few patients, there has been some significant reduction in their blood pressure, especially in the diastolic component. The reduction appeared to be greatest in those who had moderately severe diastolic levels. The study was of very short duration and a very long term evaluation would be necessary to determine the effectiveness of biofeedback in lowering hypertensive risks. The promise that some patients may be controlled in the future without medication or surgery would seem to merit further investigation of this treatment modality.

Robert Ashley, Jr., M.D.

## BIOGRAPHICAL SKETCH

Jacqueline Zurcher-Brower Orlando was born June 11, 1937, in Sioux Falls, South Dakota. She was graduated from the Academy of the Holy Names in 1955, and received her B.A. in philosophy and speech from Barry College in 1959. The Master's degree in rehabilitation counseling was awarded to her at the University of Florida in 1963. She completed additional graduate courses at Florida State University, Tallahassee, Florida. In 1971 Jacqueline returned to the University of Florida to complete the requirements for the Doctor of Philosophy degree in counselor education.

Jacqueline has two children, Michael James and Kristine Orlando, and resides in Gainesville, Florida.

I certify that I have read this study and that, in my opinion, it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

Robert O. Stripling, Chairman  
Professor of Education

I certify that I have read this study and that, in my opinion, it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

Joseph C. Cauthen  
Doctor of Medicine

I certify that I have read this study and that, in my opinion, it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

W. B. Love  
William A. Love  
Professor of Behavioral Sciences  
Nova University

I certify that I have read this study and that, in my opinion, it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

F. R. Epting  
Franz R. Epting  
Assistant Professor of  
Psychology

I certify that I have read this study and that, in my opinion, it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.



---

E. L. Tolbert  
Associate Professor of  
Education

This dissertation was submitted to the Department of Counselor Education in the College of Education and to the Graduate Council, and was accepted as partial fulfillment of the requirements for the degree of Doctor of Philosophy.

August, 1974

---

Dean, Graduate School



UNIVERSITY OF FLORIDA



**3 1262 08553 6174**